INTRODUCTION TO THE MANUFACTURE OF SOFT DRINKS

Over the past few years we have found that many microbreweries and brewpubs have an increasing interest in producing soft drinks.

The purpose of this manual is to provide an over-view of ingredients and technical information used in the production of soft drinks.

The information provided here will be general in nature and should help you understand the basics of soft drink production.

We have included a commonly asked question section. Specific questions can be answered by contacting Northwestern Extract Company.

WATER

Water is the most predominate ingredient found in soft drinks. The quality of water used is very important. In specifying standards for water it is obvious that the water should have no impurities of any nature or kind to interfere with proper taste, color, physical appearance and carbonation of the product.

The raw supply must be from an unquestionable sanitary source. Municipal water supplies will contain chlorine which should be removed by use of a carbon purifier. The carbon purifier will also remove other unwanted color, odor and tastes. If it is necessary to remove particulate matter, the use of a sand filter or cartridge type filter should be utilized.

The alkalinity of the water is of concern. High alkalinity of beverage water neutralizes the beverage acid. In most cases you can adjust acid levels to compensate for the high alkalinity.

If you do have a water problem, small reverse osmosis, deionization and distillation units are available. These units take almost everything out of the water. This is not necessary. To reduce your water cost, you can blend your raw water into the treated water to a point making the water for beverage use.

SWEETENERS

The most expensive ingredient in a soft drink is the sweetener. You will be selling a premium product, therefore, you should not skimp on the sweetener. We suggest using a bottlers grade of cane or beet sugar. Either one will make a high quality drink. This type of sugar is called sucrose.

Dextrose or corn sugar should not be used. The sweetening ability of dextrose is only about 75% of sucrose. It will not make a good tasting drink. High fructose corn sweetener [HFCS] is different. This product is made to replace sucrose. Although it is less expensive in large quantities, when purchased in less than truckload amounts, it becomes less cost effective. It also must be stored above 85 degrees F. to prevent solidifying. There are two types of HFCS. HFCS "42" is less expensive than HFCS "55". "42" is generally used in most soft drinks with the exception of cola. Taste panels have determined that "55" makes a better tasting cola than "42". "55" can be used for all flavors if you desire.

Honey can be used for flavoring and sweetening, but should be used as percentage of total sweetener. Honey contains proteins which tend to produce a cloud in a clear type product.

Honey can add a unique taste and character to soft drinks. Molasses and malt extract can give interesting flavor as well as sweetness to products such as root beer and cream soda. Artificial sweeteners and non-nutritive sweeteners can also be used in soft drinks. There are a number of diet sweeteners available. They are generally used in combination in order to reduce cost and after taste and increase shelf life. There are a number of new products just approved as this manual is being written. Northwestern will be glad to discuss diet products and these alternative sweeteners.

FLAVORS

The flavoring ingredients used in making soft drinks must be water soluble allowing them to completely disperse throughout the drink with no separation. Flavors are supplied in two forms:

1. Extracts - The flavoring oils and compounds are dissolved in alcohol and water. Normally this form of flavor will produce a clear type of soft drink. Examples are lemon-lime [Seven-Up type], ginger ale and cream soda.

2. Emulsions - Using various types of food gums, the flavoring oils are suspended in aqueous solution. Homogenization is used to stabilize the oil in water compound. The proportions and mechanics are critical in order to prevent the oil from rising to the top or settling to the bottom of the finished drink. Citrus flavored drinks such as orange and grapefruit use this system and produce a cloudy type drink.

The source of flavor ingredients can be either natural or artificial. Natural flavors, as the name implies, are derived from fruits, roots, bark, berries, etc. They are much more expensive than artificial flavors and their quality fluctuates with geographic region and climate. The cost may change rapidly due to such conditions as drought, flood, infestation and local civil unrest.

Artificial or imitation flavorings are derived from organic compounds such as esters, aldehydes, alcohols and acids. Artificial flavors make excellent tasting products and they are readily available, stable, safe for use in food, consistent in composition and cost effective.

Soft drink flavorings are specifically formulated to be used in soft drinks. Cooking extracts sold in grocery stores are not suitable for use. If used, the finished product may not be shelf stable and off-taste or separation can occur.

ACIDS

Acidulants are used in soft drinks formulations to effectively enhance the flavor. They are referred to as flavoring acids. In some drinks, acid is used to extend the shelf life of the product. In this case, it acts as a preservative or activates the added preservative.

The most popular and versatile acid used in soft drinks is citric. It is used in most fruit flavored and some non-fruit flavored drinks.

Phosphoric acid is widely used in cola and some root beers. The flavor profile lends itself to these products, but generally limits its use in other flavors.

Tartaric acid is a by-product of the foreign wine making industry and is usually used in the formulation of grape type drinks. Like natural flavorings, tartaric acid supply is subject to large fluctuation due to adverse weather conditions. The availability and price can rapidly change.

Malic acid is sometimes used in apple type drinks. It has a flavor profile similar to citric. Due to cost and availability, citric frequently is used to replace malic acid in formulations.

Ascorbic acid which is vitamin C, is not used as a flavoring acid.

It is generally used to eliminate air in the packaged finished drink.

Air [oxygen] causes off-taste and ascorbic acid is used to prevent this problem. The ascorbic acid acts as an antioxidant. If the proper quantity is used in the formulation, it is used up in the process of scavenging the oxygen and none remains in the finished drink. If too much is added to the product, the excess amount can oxidize [bleach] the color of the drink.

COLORS

Many soft drinks contain added colorants. The color is added to enhance eye appeal, making the drink more psychologically desirable. Other than the brown shades, most soft drinks use FD&C certified colors. The brown colored drinks use caramel coloring to achieve their appearance. Both the FD&C and the caramel colorings are government approved and strictly regulated. Both are safe and stable to use in soft drinks.

Some naturally derived colors are available to the soft drink industry. Generally, these are not as acceptable for use because of high cost, instability and the possibility of causing off-taste.

PRESERVATIVES

Although soft drink manufacturers would like to make their products without the added preservative, they cannot do so without the threat of off-taste and/or spoilage.

The most widely used and cost effective preservative is sodium benzoate. There are other preservatives available. Potassium benzoate and potassium sorbate can and are used in specific applications.

The amount and application of the preservative is critical and formulation procedure and sequence must be followed closely. The amount of preservative allowed in a product is usually regulated by the FDA.

Procedural sequence must be followed to prevent incompatibility with other product ingredients. Such things as carbonation level and pH affect how a preservative is used and how effective it will be.

Preservatives are bio-stats, not bio-cides. They prevent growth of organisms, they do not kill organisms. If your product is highly contaminated, no preservative will prevent spoilage. Preservatives do not replace proper sanitation and good manufacturing practices.

SANITATION

As brewers, you are familiar with the importance of sanitation to the quality and stability of your products. When producing soft drinks, the same sanitation standards and procedures apply.

Sanitation is necessary to insure the keeping qualities, proper appearance and full flavor of any soft drink. When equipment becomes contaminated, yeast, bacteria or mold organisms begin to appear in the finished beverage.

Increased numbers of these microorganisms will cause the development of undesirable taste and odors and ultimately spoilage of the product. Nothing will kill the demand for a beverage any quicker than off-tastes and odors or product spoilage.

If you are not familiar with the recommended cleaning and sanitation procedures for your plant, we suggest you solicit the advice of a company specializing in this field. Usually, they will be able to make recommendations and also offer the necessary products to do the job.

MAKING THE PRODUCT

Soft drink production can be accomplished using two different methods. The method you use depends on the production equipment available to you, the volume of finished product required, and your production and storage tank capacities.

PREMIX Method - This procedure entails making a finished drink by combining all the ingredients in a vessel; water, preservative, sweetener. flavor, color and acid, then carbonating. Carbonating can be done with a stone in a pressure vessel or in a keg. Carbonating a beverage means dissolving carbon dioxide into the product based on temperature and pressure. The lower the temperature of the beverage the lower the carbon dioxide pressure needed to achieve a given carbonation level.

POST MIX Method - This procedure is similar to the premix method except only part of the water is used to make a finished syrup containing all the ingredients. The remainder of the carbonated water is added at the bottling production equipment or bar dispensing equipment.

Post mix allows you to make finished product using only 1/6th the production or storage tank capacity as you would have when making premix.

The following chart is a guide for carbonating certain types of soft drinks:

Carbonated Water/Seltzer	5.0 volumes
Cream Soda	2.5 - 3.5 volumes
Ginger Ale	4.0 volumes
Orange	2.0 - 2.5 volumes
Lemon-Lime/Up type	4.0 volumes
Citrus Cola/Dew	3.5 volumes
Beverage Mixers	4.0 volumes
Cola	3.5 volume
Root Beer	2.5 - 3.5 volume
All Other	3.5 volume

LABELING

Soft drink labeling is regulated by the Food and Drug Administration of the U.S. Government. It is a broad and far reaching regulation to which all soft drink manufacturers are required to comply. The complete regulation can be found in the Code of Federal Regulations # 21 sold by the government printing office. In this manual, we only mention certain provisions of the labeling code:

Type size used on many parts of the label is regulated.

The use of the words, "natural" and "artificial" in the name of the product is regulated.

Net contents declaration is regulated by the volume of bottle.

The ingredients must be listed in descending order of predominance from the most to the least. Carbonated water will be first, then the next most predominant, usually the sweetener would be listed as "sugar" or "high fructose corn sweetener".

In the ingredient statement, if artificial flavoring was used, it must be labeled as such. FD&C colors must be individually listed identifying which color and number was used, i.e. "Red 40". Caramel color should be listed as such.

Preservatives must be listed in the ingredient statement by the name and what they do, i.e. "sodium benzoate as preservative" or "benzoate of soda to retain freshness".

The Nutritional Statement can be required depending on production quantities.

Specific questions about labeling should be directed to our technical staff.

COMMONLY ASKED QUESTIONS

Q. Do I have to boil everything?

A. No, as a matter of fact, boiling would be detrimental to the flavor component of the drink. Usually, manufacturers do not heat their products. If quality ingredients are used and good manufacturing procedures are followed, heating is not necessary. If you still want to use heat, only heat the sweetener solution to 180 degrees F. This will reduce the possibility of microbiological spoilage resulting from contaminated sweeteners.

Q. Do I have to use different lines for production or dispensing soft drinks?

A. When producing and dispensing beer and soft drinks. we suggest using separate lines where vinyl or rubber is involved. Root Beer flavor seems to invade vinyl, rubber and plastic. Therefore, dedicated soft hoses are recommended. For all hard surfaces, proper cleaning and sanitizing will eliminate any flavor carry-over

Q. Do I need to register my product with the FDA or ATF?

A. No, but a license for the production of a food product is usually required by your local or state regulatory agency.

Degrees Brix, Weight and Total Solids in a gallon

Brix	Lbs/gal	Solids
3.0	8.420	0.253
3.2	8.427	0.269
3.4	8.433	0.287
3.6	8.440	0.304
3.8	8.447	0.321
4.0	8.454	0.338
4.2	8.460	0.355
4.4	8.467	0.372
4.6	8.473	0.389
4.8	8.480	0.407
5.0	8.486	0.424
5.2	8.493	0.442
5.4	8.499	0.459
5.6	8.506	0.476
5.8	8.512	0.493
6.0	8.519	0.511
6.2	8.526	0.529
6.4	8.532	0.546
6.6	8.539	0.564
6.8	8.546	0.581
7.0	8.522	0.599
7.2	8.559	0.616
7.4	8.566	0.634
7.6	8.573	0.652
7.8	8.580	0.669
8.0	8.586	0.686
8.2	8.593	0.704
8.4	8.600	0.722
8.6	8.607	0.740
8.8	8.614	0.758
9.0	8.620	0.776
9.2	8.627	0.794
9.4	8.634	0.812
9.6	8.641	0.830
9.8	8.648	0.848
10.0	8.655	0.866
10.2	8.662	0.884
10.4	8.669	0.902
10.6	8.675	0.920
10.8	8.682	0.938
11.0	8.689	0.956
11.2	8.696	0.974
11.4	8.703	0.992
11.6	8.710	1.010
11.8	8.717	1.029
12.0	8.724	1.047
12.2	8.731	1.065
12.4	8.738	1.084
12.6	8.745	1.102
12.8	8.752	1.120
13.0	8.759	1.139
13.2	8.766	1.157
13.4	8.773	1.176
13.6	8.781	1.194
13.8	8.788	1.213

Brix	Lbs/gal	Solids
14.0	8.795	1.231
14.2	8.802	1.250
14.4	8.809	1.268
14.6	8.816	1.287
14.8	8.823	1.306
15.0	8.830	1.325
15.2	8.837	1.343
15.4	8.845	1.362
15.6	8.852	1.381
15.8	8.859	1.400
16.0	8.866	1.419
16.2	8.873	1.437
16.4	8.881	1.456
16.6	8.888	1.475
16.8	8.895	1.494
17.0	8.902	1.513
17.2	8.909	1.532
17.4	8.917	1.552
17.6	8.924	1.571
17.8	8.931	1.590
18.0	8.939	1.609
18.2	8.946	1.628
18.4	8.953	1.647
18.6	8.961	1.667
18.8	8.968	1.686
19.0	8.975	1.705
19.2	8.983	1.725
19.4	8.990	1.744
19.6	8.997	1.763
19.8	9.005	1.783
20.0	9.012	1.802
20.2	9.020	1.822
20.4	9.027	1.842
20.6	9.034	1.861
20.8	9.042	1.881
21.0	9.049	1.900
21.2	9.057	1.921
21.4	9.064	1.940
21.6	9.072	1.960
21.8	9.079	1.979
22.0	9.087	1.999
22.2	9.094	2.019
22.4	9.102	2.039
22.6	9.109	2.059
22.8	9.117	2.079
23.0	9.125	2.099
23.2	9.132	2.119
23.4	9.140	2.139
23.6	9.147	2.159
23.8	9.155	2.179
24.0	9.163	2.199
24.2	9.170	2.219
24.4	9.178	2.239
24.6	9.185	2.259
24.8	9.193	2.280

Degrees Brix, Weight and Total Solids in a gallon

Brix	Lbs/gal	Solids
38.0	9.720	3.695
38.2	9.733	3.717
38.4	9.741	3.740
38.6	9.749	3.763
38.8	9.758	3.763
39.0	9.766	3.808
39.2	9.775	3.831
39.4	9.783	3.854
39.6	9.792	3.877
39.8	9.801	3.900
40.0	9.809	3.924
40.2	9.818	3.947
40.4	9.826	3.970
40.6	9.835	3.993
40.8	9.843	4.016
41.0	9.852	4.039
41.2	9.861	4.063
41.4	9.869	4.086
41.6	9.878	4.109
41.8	9.887	4.133
42.0	9.895	4.156
42.2	9.908	4.180
42.4	9.913	4.203
42.6	9.921	4.226
42.8	9.930	4.250
43.0	9.939	4.274
43.2	9.911	4.298
43.4	9.920	4.321
43.6	9.928	4.345
43.8	9.936	4.369
44.0	9.983	4.392
44.2	9.992	4.416
44.4	10.000	4.440
44.6	10.009	4.464
44.8	10.018	4.488
45.0	10.027	4.512
45.2	10.036	4.524
45.4	10.045	4560
45.6	10.054	4.585
45.8	10.063	4.609
46.0	10.071	0.956
46.2	10.080	0.974
46.4	10.089	0.992
46.6	10.098	1.010
46.8	10.107	4.730
47.0	10.116	4.754
47.2	10.125	4.779
47.4	10.134	4.804
47.6	10.143	4.828
47.8	10.152	4.853
48.0	10.161	4.878
48.2	10.170	4.902
48.4	10.179	4.927
48.6	10.189	4.952
48.8	10.198	4.977

Brix	Lbs/gal	Solids
49.0	10.207	5.001
49.2	10.216	5.026
49.4	10.225	5.051
49.6	10.234	5.076
49.8	10.243	5.101
50.0	10.252	5.126
50.2	10.262	5.152
50.4	10.271	5.177
50.6	10.280	5.202
50.8	10.290	5.225
51.0	10.299	5.252
51.2	10.308	5.278
51.4	10.317	5.303
51.6	10.326	5.328
51.8	10.336	5.354
52.0	10.345	5.379
52.2	10.354	5.405
52.4	10.364	5.431
52.6	10.373	5.456
52.8	10.382	5.482
53.0	10.392	5.508
53.2	10.401	5.533
53.4	10.410	5.559
53.6	10.420	5.585
53.8	10.429	5.611
54.0	10.439	5.637
54.2	10.448	5.663
54.4	10.458	5.689
54.6	10.467	5715
54.8	10.476	5.741
55.0	10.485	5767
55.2	10.495	5.793
55.4	10.505	5.820
55.6	10.515	5.846
55.8	10.524	5.872
56.0	10.534	5.899
56.2	10.543	5.925
56.4	10.553	5.952
56.6	10.562	5.978
56.8	10.572	6.005
57.0	10.581	6.031
57.2	10.591	6.058
57.4	10.601	6.085
57.6	10.610	6.112
57.8	10.620	6.138
58.0	10.630	6.165
58.2	10.640	6.192
58.4	10.649	6.219
58.6	10.659	6.246
58.8	10.669	6.273
59.0	10.678	6.300
59.2	10.688	6.327
59.4	10.698	6.354
59.6	10.708	6.382
59.8	10.718	6.409

Chart of Volume of Carbon Dioxide

Pounds of C02 Pressure

Temperature	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32
32	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.3	3.5	3.8	4.0	4.2	4.4	4.7	4.9	5.2	5.4
33	1.7	1.9	2.1	2.4	2.6	2.8	3.0	3.2	3.5	3.7	3.9	4.1	4.3	4.6	4.8	5.1	5.3
34	1.6	1.9	2.0	2.3	2.5	2.7	2.9	3.2	3.4	3.6	3.8	4.1	4.3	4.5	4.7	4.9	5.2
35	1.6	1.8	2.0	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.8	4.0	4.2	4.4	4.6	4.8	5.1
36	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	5.0
37	1.5	1.7	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.9
38	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.8
39	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.9	4.0	4.3	4.5	4.7
40	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.3	4.5
41	1.4	1.6	1.8	2.0	2.1	2.4	2.6	2.8	2.9	3.1	3.3	3.5	3.7	3.9	4.1	4.2	4.4
42	1.4	1.6	1.8	2.0	2.1	2.3	2.5	2.8	2.9	3.1	3.3	3.5	3.6	3.8	4.0	4.2	4.4
43	1.4	1.6	1.7	1.9	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.4	3.6	3.8	3.9	4.1	4.3
44	1.3	1.5	1.7	1.9	2.1	2.2	2.4	2.6	2.8	3.0	3.1	3.3	3.5	3.7	3.9	4.0	4.2
45	1.3	1.5	1.7	1.8	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	3.4	3.6	3.8	4.0	4.1
46	1.3	1.5	1.6	1.8	2.0	2.2	2.3	2.5	2.7	2.8	3.0	3.2	3.4	3.5	3.7	3.9	4.0
47	1.3	1.4	1.6	1.8	1.9	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.3	3.5	3.6	3.8	4.0
48	1.3	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.1	3.2	3.4	3.6	3.7	3.9
49	1.2	1.4	1.5	1.7	1.9	2.0	2.2	2.4	2.5	2.7	2.8	3.0	3.2	3.3	3.5	3.7	3.8
50	1.2	1.4	1.5	1.7	1.8	2.0	2.2	2.3	2.5	2.6	2.8	2.9	3.1	3.3	3.4	3.6	3.7
51	1.1	1.3	1.5	1.6	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	3.1	3.2	3.4	3.5	3.7
52	1.1	1.3	1.5	1.6	1.8	1.9	2.1	2.2	2.4	2.5	2.7	2.8	3.0	3.2	3.3	3.5	3.6
53	1.1	1.3	1.4	1.6	1.7	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9	3.1	3.3	3.4	3.6
54	1.1	1.3	1.4	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.6	2.7	2.9	3.0	3.2	3.3	3.5
55	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.3	3.4
56	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.1	2.2	2.4	2.5	2.6	2.8	2.9	3.1	3.2	3.4
57	1.1	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.7	2.9	3.0	3.2	3.3
58	1.0	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9	3.0	3.1	3.3
59	1.0	1.2	1.3	1.4	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.7	2.8	2.9	3.1	3.2
60	1.0	1.1	1.3	1.4	1.5	1.7	1.8	1.9	2.1	2.2	2.3	2.5	2.6	2.7	2.9	3.0	3.1
61	1.0	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1
62	1.0	1.1	1.2	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.5	2.6	2.8	2.9	3.0
63	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.6	2.7	2.9	3.0
64	0.9	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.6	2.7	2.8	2.9
65	0.9	1.1	1.2	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.2	2.3	2.4	2.5	2.6	2.8	2.9
66	0.9	1.0	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.5	2.6	2.7	2.8
67	0.9	1.0	1.1	1.2	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.6	2.7	2.8
68	0.9	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.6	2.8	2.7
69	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.2	2.4	2.5	2.6	2.7
70	0.8	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.7

NOTES