A soft drink is a nonalcoholic beverage consisting primarily of carbonated (with carbon dioxide gas added) water, sweetener, and flavorings. A soft drink may be a cola, ginger ale, ginger beer, root beer, or a fruit-flavored beverage. It is sold in bottles and cans or dispensed by a soda fountain into a glass. The name “soft drink” has been adopted to distinguish it from “hard drinks,” or alcoholic beverages.

Soft drinks account for one of every four beverages consumed in the United States. According to the National Soft Drink Association, Americans drink an average of fifty-four gallons of soft drinks per person a year.

**Bubble bath**

The roots of soft drinks can be traced to ancient times. About two thousand years ago, Greeks and Romans recognized the medicinal value of mineral water and bathed in it for relaxation, a practice that continues today. Mineral water is spring water containing mineral salts and gases. One of the gases is carbon dioxide, later an important ingredient in soft drinks.

Starting around the 1300s, Europeans bathed in natural springs for their curative benefits. Some of the springs produced bubbles, which scientists concluded was due to the carbon dioxide gas dissolved in them. The American Indians were using “medicinal waters” long before the first colonists arrived in the United States.
Manmade mineral water

In 1767, British chemist Joseph Priestley (1733–1804) made the first carbonated water by adding water to carbon dioxide gas from fermented beer. Shortly after, Swedish chemist Torbern Bergman (1735–1784) invented a device that produced large quantities of mineral water from chalk. By the late 1700s, Europeans and Americans were drinking the sparkling mineral water for their health. In 1798, the term “soda water” was first used to refer to the manmade mineral water. In the United States, the first manmade soda water was patented in 1809. It consisted of water and sodium bicarbonate mixed with acid to produce gas bubbles.

Pharmacists in the United States and Europe, who sold most of the soda water, experimented with many ingredients in the hope of finding new remedies. These included dandelion, birch bark, sarsaparilla roots, and raspberry and strawberry leaves. Some pharmacists used fruit extracts of lemons and oranges, while those who were also chemists invented artificial colors and flavors. Before long, people were buying soda water just for its refreshing taste. Starting in the early 1800s, drug store soda fountains became popular gathering places for the local people. The market expanded in the 1830s when soda water was first sold in glass bottles. In 1850, the invention of a filling and corking machine solved the problem of capping the gaseous bottles. Unlike the Crown Soda Machine (see sidebar on page 249), the device called for a two-step filling, first with syrup, and then with carbonated water.

Caffeinated soda water

In 1886, a Georgia pharmacist, John Pemberton (1831–1888), created what would become the world’s most famous drink, Coca-Cola™. Originally advertised as a medicinal beverage, his recipe included, among other ingredients, the extracts of the known stimulants coca leaves and cola nuts. In 1898, Caleb Bradham (1867–1934) of North Carolina invented Pepsi-Cola, named after cola nuts and pepsin, an acid that aids in digestion. However, Bradham did not advertise his product as a curative beverage. By the early twentieth century, like Bradham, most cola companies advertised their products not as medicines but as refreshments.

Growing thirst

The rapid popularity of the newly invented automobiles in the early 1900s contributed to the growth of the soft drink industry. Vending
machines, dispensing soft drinks in cups, became regular fixtures at the service stations starting in the early 1920s. In the mid-1960s, for the first time, Coca-Cola and Pepsi-Cola were sold in all-aluminum cans, equipped with pull-ring tabs and later with stay-on tabs (created in 1974). In 1970, plastic bottles were used for soft drinks. Although another type of plastic called PET (polyethylene terephthalate) was invented in 1973, the soft drink industry did not use it in large quantities until 1991.

Soft drink companies are constantly on the lookout for consumer preferences. In the 1950s, after the sales of Pepsi-Cola rose when its sugar content was reduced, the first no-cal (calorie) beverages using the artificial sweetener saccharin were introduced. Since then, other new products have been introduced. They include diet, caffeine-free, low-sodium, and preservative-free drinks. Clear colas, as well as soft drinks with a lemon twist, have also been developed.

**Raw Materials**

A soft drink is made up of about 94 percent carbonated water. Carbon dioxide adds that special sparkle and bite to the beverage. It also acts as a
One Man’s Practical Inventions

Two inventions during the early years of the soft drink industry helped perfect the bottling of carbonated beverages for home use. In 1892, William Painter (1838–1906) invented the Crown Cork Cap, a metal cap with corrugated edges that gripped the neck of the bottle. Inside the cap was a thin piece of cork and a special paper that sealed the bottle and prevented the soft drink from coming in contact with the metal cap. Previously, the numerous bottle caps that had been introduced were not tight enough so that the soft drinks leaked or the carbon dioxide gas escaped from the bottle. Also, bottled drinks tended to change in taste and color after coming in contact with the metal caps.

In 1898, Painter invented the Crown Soda Machine, which filled and capped bottles at the same time. The machine consisted of a carbonated water line and a syrup line that fed the ingredients into one opening, so that the beverage came out of the machine already mixed. A bottle was filled, and then a press (a machine that uses pressure) on which a Crown Cork Cap had been placed crimped the cap over the bottle top, sealing it tightly. The first machine to incorporate the ingredients in a single step, Painter’s invention is the ancestor of today’s automated machines for bottling soft drinks.

pectin: A substance found in the rind of citrus and other fruits.

pH: A measure of the acidity of a liquid or solution.

polyethylene terephthalate (PET): A type of plastic used for packaging food and nonfood products. It is lightweight, inexpensive, break-resistant, and recyclable.

mild preservative. Carbon dioxide is an inactive (does not react with other substances), colorless, and odorless natural gas. It is nonpoisonous, relatively inexpensive, and easy to liquefy (to cause to become liquid). The hissing sound and small bubbles resulting from the opening of a soft drink container are caused by the escape of carbon dioxide when pressure in the can is released.

Sugar, the second main ingredient, makes up 7 to 14 percent of a regular (nondiet) soft drink. Used in either dry or liquid form, sugar adds sweetness and body to the beverage, increasing the mouthfeel (physical sensation of food in the mouth), an important part of consumer enjoyment of a soft drink. Sucrose (made from sugar cane or sugar beets), high fructose corn syrup (made from cornstarch), or a combination of both sweeteners may be used.

Diet, or sugar-free, soft drinks use sugar substitutes, also called “diet” or “low-calorie” sweeteners. They include aspartame, saccharin, sucralose, and acesulfame-K (acesulfame potassium). A soft drink may use one sugar substitute or a combination of sugar substitutes.

Acids are added to soft drinks to give them a pleasant sharpness and to quench the thirst by stimulating saliva flow. They also act as a preserv-
The most commonly used acids are citric acid, which gives a lemony flavor, and phosphoric acid. Other acids, such as malic acid or tartaric acid, may also be used.

Flavoring is a very important ingredient in soft drinks. Natural flavors come from natural extracts and oils, as well as spices. For example, an orange-flavored soft drink typically contains an orange extract. Root beer and ginger ale use flavors made from spices and herbs. Some soft drinks may use artificial, or manmade, flavorings.

Small amounts of other ingredients are added to soft drinks. Caffeine, one of the ingredients added to cola- and pepper-type soft drinks first introduced in the 1800s, is still used to enhance the flavorings used. Emulsions, consisting of water and such substances as gums and pectins, add to the “eye appeal” by acting as clouding agents. In beverages, such as cream soda, ginger beer, and root beer, saponin is added to produce a foam. Color used in soft drinks may come from natural or artificial color or a combination of both. Preservatives, including the antioxidants BHA and ascorbic acid, are used to maintain the taste, color, and flavor of the beverages.

The Manufacturing Process

Most soft drinks are generally produced at local bottling and canning companies. A soft drink manufacturer grants a company or companies a franchise (the authorization to sell his or her products in a certain area). That franchise company in turn grants a license (an official permission) to a bottling or canning company to mix the soft drink strictly following the secret formula and manufacturing procedures.
Clarifying the water

A regular soft drink contains about 90 percent water, while a diet soft drink can have as much as 99 percent water. Impurities, such as suspended particles, organic matter (the remains of living things), and bacteria may diminish the quality of the taste and color of the soft drink. Impurities are removed through a series of coagulation, filtration, and chlorination processes.

During coagulation, a gelatinous precipitate, or floc (ferric sulphate or aluminum sulphate), is mixed into the water. The floc absorbs the tiny impurities, forming a larger mass that will then be trapped by filters. Lime is added to reach the desired pH, or acidity, of the water.

**sterilization:** The destruction of living microorganisms by using a substance, such as chlorine, or by heating.
Filtering, sterilizing, and dechlorinating the water

2 The clarified water is poured through a sand filter to remove the particles of floc. First, the water passes through a layer of sand and then layers of fine and coarse gravel to trap the particles.

3 Bacteria and organic matter that might spoil the water’s taste or color have to be destroyed. This is done by pumping the water into a storage tank in which a small amount of free chlorine is added. The chlorinated water is kept in the tank until the water is completely purified.

4 An activated carbon filter removes the chlorine and other remaining organic matter. (Activated carbon is carbon in the form of a powder or granules that purifies liquids by collecting impurities on its surface.) Then, a vacuum pump removes all the air from the water before it moves to a dosing station.

Mixing the ingredients

5 The dissolved sugar and flavors are pumped into a dosing station in a predetermined sequence. They are transported to batch tanks where they are carefully mixed to form a syrup. The syrup may be
sterilized while in the tanks using ultraviolet radiation. Flash pasteurization may also be used to kill any microorganism in the syrup. This involves quickly heating and cooling the syrup. Fruit-based syrups generally must be pasteurized.

The water and syrup are carefully blended by proportioners, machines that control the amounts and flow rates of the two ingredients. To keep air from entering the mixture, carbon dioxide is used for pressure.

**Carbonating the soft drink**

Carbonation (the addition of carbon dioxide gas) is generally performed when the product is completed, although it may be done at an earlier stage. The temperature of the soft drink has to be controlled, so that it is not too cold, causing the carbon dioxide to dissolve in it when added.

The amount of carbon dioxide pressure added depends on the type of soft drink. For example, fruit drinks require less carbonation than mixer drinks, such as tonics, which are intended to be diluted with other liquids.

**Filling and packaging**

The finished beverage is poured into bottles or cans and immediately sealed with pressure-resistant closures. Closures used may be tinplate or steel crowns with corrugated (having parallel grooves and ridges) edges, twists-off caps, or pull-tabs.

Soft drinks are generally cooled during manufacture. Before labeling, the soft drinks are brought to room temperature to prevent condensation from ruining the labels. (Water vapor in the air will condense, or change to liquid, if it comes in contact with the cold containers.) This is done by spraying the containers with warm water and drying them. Labels, containing information about brand name, ingredients, shelf life, and safe use of the product, are then attached to the bottles. Most labels are made of paper, although some are made of plastic film. Cans are usually preprinted with product information before being filled.

Finally, the soft drinks are packed into cartons or trays, which are then loaded into pallets or crates to be shipped to distributors.

**Quality Control**

Soft drink manufacturers follow strict water quality standards for allowable dissolved solids, chlorides, sulfates, iron, and aluminum, as
The interior of a coin-operated soda machine. Photograph by Kelly A. Quin. Copyright © Kelly A. Quin. Reproduced by permission of the photographer.
well as water alkalinity. The use of clean water ensures that the finished products will have a consistent taste, flavor, and color. This means that a product sold in one area tastes and looks identical to the same product sold in another location. Effective removal of impure particles from the water facilitates the production process because blockage due to impurities is eliminated. Testing for the presence of microorganisms is done regularly.

The National Soft Drink Association and other agencies set standards for regulating the quality of all ingredients. Monitoring the quality of sugar is especially important. To prevent spoilage, sugar has to be carefully handled in dry, clean environments.

Raw materials are inspected as they arrive at the factory and before they are mixed with other ingredients because preservatives may not kill all bacteria. All tanks, machines, and containers are thoroughly sterilized. Cans that are made of aluminum alloy (a mixture of aluminum and another metal) or tin-coated low-carbon steel are lacquered (coated with a baked-on finish) internally to seal the metal and prevent corrosion when it comes in contact with the beverage.

Manufacturers also recommend specific storage conditions to retailers to ensure that soft drinks do not spoil. The shelf life of soft drinks is about one year.

The Future

Nearly 450 different beverages are manufactured in the United States. Companies constantly develop new flavors. Most diet soft drinks use the sweetener aspartame, first approved for soft drinks in 1983 by the U.S. Food and Drug Administration (FDA). Manufacturers are always experimenting with new sweeteners that are several times sweeter than sugar. The sugar substitutes acesulfame-K and sucralose, approved for use in soft drinks in 1998, are used alone or combined with other sweeteners.

Trends in the soft drink industry continue to consider public health, safety, and the environment. New methods of water purification and ster-
ilization will improve production and minimize the need for preservatives in soft drinks. On July 5, 2002, the FDA approved a new sugar substitute, neotame, for use in certain food products, including soft drinks. Depending on its use in food, neotame is 7,000 to 13,000 times sweeter than sugar.

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