confectionery ingredients and equipment

chapter one

Confectionery is arguably the most demanding of the culinary arts, requiring a degree of precision and accuracy unequaled in other areas of the kitchen. A batch of confectionery centers is not as forgiving as a batch of bread or cake. Because confections themselves are smaller than pastries or baked goods, a typical batch of confections uses smaller increments of each ingredient. When scaling and handling small quantities, slight errors translate as sizeable percentages of the total. In addition to this basic requirement of precision in the amounts of ingredients, confectionery art demands precise handling techniques. Cocoa butter will only crystallize in a desirable form under specific conditions; if the temperature is a few degrees off, or the amount of agitation is not adequate, the chocolate will bloom, resulting in a ruined product. Sugar too requires exact control over percentage, temperature, and handling in order to achieve the desired result, whether that is the prevention or formation of crystals. These are just some of the factors that the artisan confectioner must deal with every day. By understanding the ingredients commonly used in confectionery, knowing the proper use of confectionery tools, and mastering the basic processes, the artisan confectioner can bring to fruition any creative inspiration. As compared with cooking or even baking, confectionery involves relatively few ingredients. It is how those ingredients are handled, and the relative quantities of each, that makes each confection unique. Understanding the basic properties of each ingredient, and how they interact, enables the confectioner to be more successful in creating precisely the results desired. The importance of this cannot be overstated: when a professional truly understands ingredients, there is nothing that he or she cannot accomplish in formulation.

sweeteners

Sweeteners are the heart of confectionery. One of just five tastes that the human tongue can detect, sweetness is a defining quality of confections. So, naturally, sugars are essential ingredients in confectionery. In addition to providing flavor, sweeteners play a number of roles in confectionery, including acting as a preservative, doctor, bulking agent, humectant, and source of crystallization. The most commonly used sweeteners in confectionery are sucrose and glucose syrups, but many other sweeteners are also employed for their unique flavors and functionality.

Sucrose and derivatives

While the word *sugar* may rightfully be applied to a variety of nutritive carbohydrate sweeteners, when the term is used without any modifiers, it refers to sucrose. Sucrose is a disaccharide made up of one molecule of fructose (also known as levulose) bonded with one molecule of dextrose (also known as glucose). The sucrose commonly used in confectionery is one of the purest food substances available—99.8 percent or higher pure sucrose.

Commercially, sugar is obtained from sugarcane or sugar beets. Although the refining methods are different, thanks to excellent processing technology, there is no difference between the sucrose obtained from either source. While artisan confectioners typically purchase sugar in dry crystalline form, mass-production manufacturers are more likely to buy liquid sugar, a syrup consisting of approximately 67 percent sucrose dissolved in water, because it is easier to handle in larger quantities.

A defining feature of sucrose is its tendency to crystallize at high concentrations. Understanding this tendency and knowing how to control it are two of the most fundamental concepts in confectionery. (See Saturation and Supersaturation, page 179.) Crystalline sucrose and noncrystalline (amorphous) sucrose behave very differently in terms of hygroscopicity, stability, water activity reduction, and flavor release. (See the table on page 3.) At common room temperatures, sucrose is soluble to approximately 67 percent solids—that is, 67 percent sugar and 33 percent water. In order to be shelf stable, sugar confectionery needs to have a dissolved-solids content of approximately 75 percent or higher. If the product is to remain noncrystalline, as with hard candies and brittles, sucrose alone is not usually acceptable as a sweetener, and doctoring agents must also be added in order to promote stability and prevent crystallization. Glucose syrups are the most commonly used adjunct sweetener to prevent crystallization and increase the solids content.

Sucrose is available in a wide range of crystal sizes and in powdered form with various particle sizes. Powdered sugar, referred to in this book as confectioners' sugar, is categorized by its degree of fineness, specified by a number, with the highest number indicating the smallest particle size. The 6X and 10X sugars are the most commonly found confectioners' sugars, but others are also available. American-made confectioners' sugar is an exception when it comes to the purity of sucrose, as it contains approximately 3 percent cornstarch to prevent caking.

Molasses

A thick brown syrup that is a by-product of the sugar refining process, molasses is used in confectionery primarily for its distinctive flavor and its doctoring properties. Because it contains a significant amount of invert sugar, minerals, and amino acids extracted during the refining process, it has a tendency to brown during cooking, as a result of the Maillard reaction (see page 185), and to increase the hygroscopicity of products that contain it.

sucrose qualities

Noncrystalline sucrose	*Crystalline sucrose*
Exhibits high level of hygroscopicity	Exhibits relatively low level of hygroscopicity
Reduces A_W	Has little effect on A_W
Holds fat in emulsion	Expels fat
Dissolves quickly in the mouth	Dissolves more slowly in the mouth
Is chemically reactive	Is not chemically reactive
Releases flavor relatively rapidly	Releases flavor more slowly

Molasses is available in varying degrees of darkness and flavor intensity. When it is obtained earlier in the sugar refining process, it is lighter in color and flavor; molasses from the later stages of refining has a darker color and a more intense flavor. The darkest molasses is known as blackstrap molasses, and is used primarily in the distilling industry, in yeast manufacturing, and for animal feed, although a small percentage of it is sold for use in human food. All molasses that is used for human consumption comes from sugarcane, not sugar beets.

Brown sugar

The most common form of brown sugar is made by fully refining sucrose and then restoring a measured amount of cane sugar molasses to the refined sugar. The result is sugar crystals that have a thin molasses coating and a soft, moist texture. The added molasses provides flavor and increases the sugar's hygroscopicity and its propensity for browning when heated. Producing brown sugar by this method affords the manufacturer control over the product, permitting greater uniformity from batch to batch. Brown sugar is available in several grades, depending on the type of molasses and other ingredients added to it. Commercially, brown sugar is given a number to indicate how dark it is, with the highest number indicating the darkest sugar. The most commonly found grades of brown sugar are 6, 8, 10, and 13.

Turbinado sugar is a type of brown sugar that is produced by leaving some of the molasses in during the refining process, rather than fully refining the sugar and then adding molasses back to it. Because the molasses in turbinado sugar is inside the crystal rather than on its surface, this sugar is not soft and moist like the commonly produced brown sugar, but consists of hard crystals with a golden hue. Whether it deserves it or not, turbinado sugar has developed a reputation as a more natural alternative to fully refined white sugar. It is available in various crystal sizes.

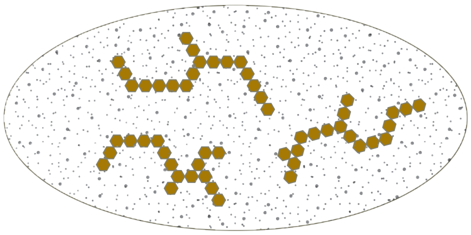
Invert sugar

Invert sugar is made by splitting the disaccharide sucrose into its two component monosaccharides, fructose (also known as levulose) and dextrose (also known as glucose). (See Inversion, page 177.) Commercially, inversion may be accomplished by exposing sucrose to an acid, or treating it with the enzyme invertase. Invert sugar is valued by confectioners for its doctoring capacity, which is its most common function in confectionery formulation. It is sweeter than sucrose, more hygroscopic, and unlike sucrose, it readily contributes to Maillard browning. (See Maillard Reaction, page 185.) Because sucrose alone is soluble only to approximately 67 percent at room temperature, and invert sugar is soluble to approximately 80 percent, invert sugar is frequently added to sugar confectionery to increase the dissolved-solids content, lower water activity, and extend shelf life. Invert sugar is most commonly found as a creamy liquid paste containing approximately 80 percent solids.

Glucose syrup

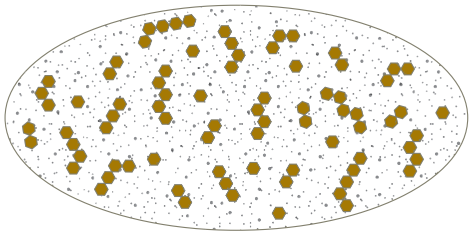
Glucose syrup is the legal name for nutritive sweeteners made by the hydrolysis of edible starch. The name of the source starch may replace the word *glucose* in the name of the syrup; for example, *corn syrup* is a permissible name for glucose syrup derived from cornstarch. Glucose syrups are made by hydrolyzing the long sugar chains (polysaccharides) that make up starch into shorter chains of sugar molecules. The process of breaking the bonds between dextrose molecules during syrup manufacture is called conversion, and it is accomplished with the use of acids, enzymes, or both. (See conversion diagram below.) Most American glucose syrups are made from cornstarch because of its wide availability and low cost, and are commonly known as corn syrup. In Europe, most glucose syrups are made from wheat or potato starch, but there is effectively no difference between syrups made from corn, wheat, or potato starch.

Starch



Starch is a polysaccharide. Each molecule is made of thousands of dextrose molecules bonded together.

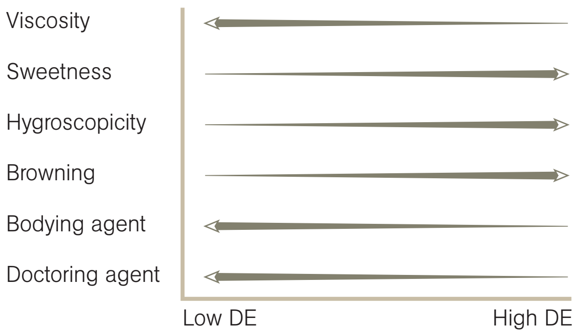
Plus Acid &/or Enzymes



Equals Glucose Syrup

When treated with acid or enzymes, the starch molecule is broken down or converted into shorter sugar chains. Glucose syrup is a blend of short and long sugar chains in a small amount (about 20%) of water.

Characteristics of Glucose Syrups



The DE of glucose syrup greatly influences many of the syrup's characteristics. The table illustrates some of the differences between lower- and higher-DE syrups. The arrows indicate an increase in the given quality as the DE number changes. For instance, viscosity increases as DE decreases, and sweetness increases as DE increases. While these are good general guidelines, specialty glucose syrups such as high-maltose syrup and high-fructose syrup may exhibit slightly different qualities.

One of the most important factors when selecting a glucose syrup is the syrup's DE, or dextrose equivalent. DE is the specification used to describe how much the starch molecule has been broken down into simpler sugars. Starches are made up of thousands of dextrose molecules chemically bonded together. While it is not exactly chemically accurate, the DE of glucose syrup may be considered roughly the percentage of the starch that has been converted to sugar. For instance, unhydrolyzed starch has a DE of zero; that is, none of the bonds have been broken. Pure dextrose has a DE of one hundred, meaning that 100 percent of the bonds from the original starch molecule have been broken, resulting in 100 percent single dextrose molecules.

The DE of glucose syrup profoundly influences the syrup's characteristics. High-DE syrups are sweeter, more hygroscopic, less viscous, and more prone to Maillard browning than are low DE syrups. (See comparison table above.) The glucose syrup most commonly used in confectionery is of approximately 42 DE. When a formula calls for glucose syrup or corn syrup without specifying the DE, this is the syrup that should be used. Other commonly available syrups include those of 27 DE and 63 DE, each with its own degrees of viscosity, reactivity, sweetness, and so on.

Understanding the concept and ramifications of DE is only the beginning of selecting a glucose syrup. Some specialty glucose syrups that are widely available include high-fructose syrup and high-maltose syrup, which are produced by the action of enzymes that create a particular carbohydrate profile. Each syrup has its own unique qualities. Of most interest to artisan confectioners, though, is high-maltose syrup. It browns less at high temperature, has lower viscosity, when hot, and has lower hygroscopicity. Many of the European-made glucose syrups are high maltose, and American manufacturers also make a range of high-maltose syrups.

Glucose syrup manufacturers produce a variety of syrups of varying DEs and carbohydrate profiles, for a wide range of applications. When special syrups are desired, it is advisable to contact the manufacturer for their recommendations regarding the application in question and to obtain a sample for trial use. Specification sheets that list the DE, conversion process, and carbohydrate profiles for syrups are available from manufacturers and on their Web sites.

Honey

Honey is the syrup that bees produce from gathered plant nectar. Chemically, honey bears considerable resemblance to invert sugar; the sugars in it are mainly fructose and dextrose in nearly equal proportion, with a moisture content of approximately 17 percent. In addition to these main components, honey contains smaller quantities of other sugars, as well as proteins and compounds that provide its characteristic flavor and color. The flavor and color of honey is greatly influenced by the types of flowers from which the bees gather the nectar. Therefore, honeys can range from the dark, richly flavored buckwheat honey to the lighter orange blossom honey. Many other honeys are available, each with a unique flavor profile. Although it possesses the same doctoring and humectant properties as invert sugar, honey browns more readily during cooking and is used in confectionery mainly to impart its flavor.

Maple

Maple syrup and maple sugar are both made by concentrating the sap from the sugar maple tree. Sap from maple trees typically contains approximately 2 percent sugar, nearly all of which is sucrose. To concentrate the sugar, the sap is boiled in open evaporators in order to remove the desired quantity of water. Maple syrup is boiled to a dissolved-solids content of just over 66 percent. At this concentration, the syrup is saturated, but will not crystallize easily. Maple sugar is made by removing more water and inducing crystallization of the sugars. In addition to removing water, boiling causes Maillard browning which is crucial to the development of maple syrup's characteristic flavor. The flavor of maple syrup is also influenced by environmental factors, such as climate, soil type, and the time of the season when the sap is harvested. The highest grade of maple syrup is the lightest in color and flavor; the lowest grade is the darkest, with a less subtle, more robust flavor, and may therefore be better suited to confectionery applications.

Alternative sweeteners

A wide range of alternative sweeteners is available, with still others in development all the time. These range from the polyols, or sugar alcohols, such as sorbitol and maltitol, to aspartame and sucralose. These sweeteners unquestionably have applications in the marketplace; for example, they are suitable for consumption by those with diabetes or those wishing to avoid simple carbohydrates. Alternative sweeteners are a discipline in and of themselves; they behave very differently from traditional carbohydrate sweeteners, and each has its own unique properties. This book focuses on the creation of artisan confectionery using traditional ingredients and methods, so alternative sweeteners will not be used in the formulations or addressed in the explanations of theory.

fats

Fat plays a vital role in many types of confectionery, from chocolate to caramels and nougat, and ganache fat improves viscosity, texture, flavor, and mouthfeel. Many different fats are available to the confectioner, including hydrogenated and/or fractionated fats manufactured for specific confectionery applications. Although these fats have something to offer, they are generally designed to act as lower-cost replacements for the fats used in traditional formulations, such as butter, cocoa butter, and coconut fat. The formulations in this work use these traditional fats, and do not include the hydrogenated alternatives.

Cocoa butter

Cocoa butter is the most important fat in confectionery; it also is among the most expensive and most difficult to work with. One unique quality of cocoa butter is its narrow melting range, which is just below normal human body temperature. As a result, cocoa butter remains solid up to a temperature very close to its melting point, and then melts rapidly. This is why even at a warm room temperature, chocolate remains crisp, but it melts rapidly in the mouth. Cocoa butter's polymorphism makes it relatively difficult to work with (see Polymorphism of Cocoa Butter, page 47), and because it must be pressed from cocoa beans, themselves an expensive commodity, it is also costly. Aside from its use in chocolate, cocoa butter may be added to some confection centers to improve shortness and firmness. (More information on cocoa butter may be found in Chapter 2.)

Butter

Butter is the second most frequently used fat in artisan confectionery. It may be added to confections either directly or through the use of dairy products containing butterfat. Butter used for confectionery should always be unsalted sweet cream butter.

Butter is obtained by churning cream, agglomerating the fat, and then separating the butter from the remaining buttermilk. Butter is not a pure fat but an emulsion of water in fat; it also contains milk solids and lactose. (See Emulsions, page 80.) Because of the presence of protein from the milk solids, and lactose, butter contributes to Maillard browning when it is cooked in confectionery formulas.

Butterfat may be isolated from the water and other components by boiling the butter and separating the emulsion. This results in pure butter oil that contains no moisture. It is this anhydrous form of butter that chocolate manufacturers sometimes use when making chocolate.

One of the primary functions of butter in confectionery is to combine with cocoa butter to create a softer fat that will melt at a lower temperature than pure cocoa butter would. This is desired both for centers such as ganache, and sometimes for chocolate that is manufactured with the addition of butterfat as a bloom inhibiter.

Lauric fats

Lauric fats are occasionally used by the artisan confectioner, primarily for the powerful eutectic effect they have when combined with cocoa butter. (See Eutectics, page 343.) Examples of lauric fats are coconut fat and palm kernel oil; of the two, coconut fat is more commonly used by the artisan confectioner. When it is combined with cocoa butter, the resulting eutectic often has a melting point that is lower than either of the original fats, resulting in a meltaway center.

Coconut fat is a relatively hard fat at room temperature, and may be fractionated to provide specific desired melting points. A coconut fat with a melting point of 92ºF/32ºC is commonly available, and is well suited to the formula applications in this book. Deodorized coconut fat should be used to avoid contributing undesired coconut flavor to confections. When deciding whether to use lauric fat, the confectioner must take into account flavor, texture, and reactions with other ingredients such as cocoa butter.

dairy products

Dairy products play several important roles in confectionery, including providing moisture, amino acids, and lactose for Maillard browning, contributing to confections' fat content, and acting as an emulsifier. Dairy products are available to the artisan confectioner in many forms, each with its own advantages. Substitutions can be made for them, depending on the fat, water, and milk-solids content of the various alternatives available.

Fresh and cultured dairy products

Fresh dairy products include nonfat milk, whole milk, half-and-half, and cream. The single primary difference among them—fat content—is the property by which the FDA defines and classifies each of these fresh dairy products. Fresh dairy products are valued by the artisan confectioner for their flavor, and when possible, these are the dairy products of choice.

The main drawbacks of fresh dairy products are storage requirements, high water content, and cost. Dairy storage seldom presents a large obstacle to the artisan confectioner, who purchases such products frequently and in small enough quantities that storage does not become an issue. Water content can be a problem, though, when making confections such as caramels, which use a large quantity of dairy product and require long cooking to remove moisture.

Although it is possible to use all fresh dairy products to make these confections, the prolonged cooking times required not only would make them less efficient to produce, but also could cause the milk solids to curdle. For these confections, therefore, processed dairy products can be used. They provide all of the milk solids necessary, with less water to remove during cooking. A combination of fresh and processed dairy products can provide some of the advantages of each. However, fresh dairy products are always the ingredient of choice when making ganache.

Cultured dairy products, such as yogurt, sour cream, and buttermilk, are seldom used in artisan confectionery because of their tendency to curdle when heated. One minor exception is crème fraîche, which can be used to make ganache—provided it is not heated to a temperature sufficient to cause curdling.

Processed dairy products

The processed dairy products commonly used in confectionery include sweetened condensed milk, evaporated milk, and dry milk. Each has its own characteristics that make it suited to particular applications.

Sweetened condensed milk must contain 8 percent milk fat, 28 percent total milk solids, and, since it is not heat-treated during canning, sufficient sugar to prevent spoilage. Sweetened condensed milk is more resistant to curdling during cooking than either evaporated milk or fresh dairy products. This stability, combined with the milk's low moisture content, makes it the dairy product of choice in many caramel formulas.

Evaporated milk is whole milk that has had a substantial portion of its water removed, is heat-treated to prevent spoilage, and must be refrigerated after opening. The reduced water content of evaporated milk, as compared with fresh dairy products, makes it well suited to caramel production, although it is more prone to curdling than sweetened condensed milk.

flavoring and coloring agents

Flavors used in artisan confectionery are most often aromatic food ingredients such as spices, nuts, extracts, and purées. In certain cases, as with hard candies, it is difficult and impractical to use these ingredients, so manufactured flavors must be employed. These may be either "natural flavors" or "artificial flavors." Other than the labeling regulations, there is little difference between the two. Each category of flavoring is created by combining various organic compounds to replicate the aroma of a naturally occurring item. The only difference between natural and artificial flavors is the source of the chemicals used to make the flavoring.

The FDA has precise guidelines for how flavorings can be labeled. For a flavoring to be called "natural," its components must be derived from plant materials, meat, dairy, or seafood sources, by any of a number of processes, including extraction, distillation, fermentation, and hydrolysis. "Artificial" flavors are those whose components do not come from these sources. All natural and artificial flavors used in a product must be declared on its label. Natural flavorings typically command a higher price because deriving components from the allowable food and plant sources is more expensive than obtaining them from other sources, and because consumers value the term *natural* and are often turned away from anything containing the word *artificial*. Artisan confectioners should be extremely judicious in the use of manufactured flavors, adding them to only those products that cannot practically be flavored with food ingredients.

Other types of flavoring occasionally used by artisan confectioners are organic acids such as citric acid, naturally occurring in lemons; malic acid, naturally occurring in apples; and tartaric acid, naturally occurring in grapes. When used as flavoring agents, these acids are intended to balance sweetness and more realistically mimic fruit flavors. Each type of acid has its own flavor-release profile, and will affect a confection's flavor differently. These same acids may be used as components in confectionery reactions such as sugar inversion, starch hydrolysis, and pectin gelling. Because of their reactivity, great care must be taken with regard to the amount of acid used, and the stage at which it is added. These ingredients can also be harmful to skin and eyes, and therefore must always be handled with care.

Colors

In certain areas of confectionery, the addition of color is normal and expected. It is difficult to imagine hard candies without added color, and truly striking effects can be obtained by coloring chocolate and using molds to make confections. It is part of the philosophy of artisan confectionery, however, that, when possible, no unnatural color or flavor should be added.

Colors for confectioners are divided into two categories: fat-soluble colors and water-soluble colors. Fat-soluble colors are used for coloring chocolate or cocoa butter. They are designed to dissolve in fats, and so are ideally suited for use in chocolate. Fat-soluble colors are commonly found either in a liquid form that is pre-dissolved in oil or cocoa butter, or in a powder form that is not yet dissolved. The pre-dissolved form is slightly more convenient to use, but similar results can be obtained from either variety. When dry colors are used, they first must be dissolved in a small quantity of cocoa butter, which is then mixed into chocolate or more cocoa butter for application. Dry colors are often difficult to dissolve fully, and can require agitation and grinding. For this reason it is advisable to prepare in advance a quantity of colored cocoa butter that can simply be melted and used when needed.

Water-soluble colors are used to color hard candies and other aqueous systems. These colors are available in liquid, paste, gel, and dry forms. Dry colors should be hydrated before being added to a mixture. Whatever form of color is used, it should be as concentrated as possible, so as not to add too much water to the confection, thus softening it. This is particularly important for hard candies if they are colored after cooking. To minimize water content, it is advisable to use paste and dry colors, which are best suited to most sugar confectionery.

nuts and seeds

Nuts and seeds are commonly used in confectionery for their flavor, texture, and fat content. Various nuts may be used by the artisan confectioner, including hazelnuts, almonds, pecans, and macadamias. While they all differ botanically, their general qualities and handling requirements are virtually the same. Their common trait is a high fat content, and the fat they contain is prone to rancidity. All nuts and seeds should be stored in a cool place, away from light, oxygen, and reactive metals such as cast iron or copper, all of which can contribute to the onset of rancidity. The flavor of most nuts is improved from roasting prior to their use. Different nuts reach their peak flavor with different degrees of roasting, and it is up to the confectioner to determine what level of roasting most flatters each variety of nut.

The oil content of nuts is a double-edged sword; oil is responsible for much of nuts' appeal, but it does not store well and can be responsible for fat migration, resulting in softened chocolate and fat bloom. The more finely ground the nuts in a confection are, the more fat is released, and the more pronounced these effects can become. Seeds such as sesame seeds, pumpkinseeds (pepitas), peanuts, and cocoa nibs are all similar to nuts in their storage and usage guidelines.

water

Water is likely the most overlooked ingredient in confectionery, and yet is among the most important. Almost every confection contains some quantity of water, and water serves vital functions in confectionery, including controlling texture and influencing shelf life. It also acts as a solvent to dissolve sugar and as a medium in which reactions such as Maillard browning can occur.

Controlling the amount of water in products is one of the most fundamental steps in confectionery. Water content directly affects the consistency of all finished products, from ganache to marzipan to hard candy. Along with affecting a confection's firmness, excessive free water can also lead to spoilage. (See Water Activity, page 36.) The total water content of confectionery is controlled by cooking to remove the desired quantity of water; the amount of free water is controlled by the dissolved-solids content, which binds water, preventing spoilage.

In confectionery, it is often necessary to dissolve sugar, regardless of whether the end results are to be crystallized, as with fudge and fondant, or amorphous, as with toffee, caramels, and hard candies. Water acts as a solvent for sugar. It is also the medium that permits the myriad reactions that regularly occur in confectionery. Maillard browning, inversion, and emulsification are a few of the common reactions and processes that benefit from or require water.

Water in confectionery may come from dairy products, fruit purées, or fruit juice, or, more commonly, it is added to formulas directly. Potable tap water is perfectly adequate for confectionery use, but there are occasions when differences between various sources of water may become apparent. The most common differences are in pH and mineral content.

Most tap water is somewhat acidic; the more acidic the water, the more inversion will occur when that water is used to cook confections. Although a small difference, it may be noticeable with sugar confectionery such as hard candies, where excessive inversion can make the candies soft and sticky, and with fondant or fudge, where excessive inversion can make the mixtures more difficult to crystallize and can result in a softer product. Water with a high mineral content can also contribute to sugar inversion. Because of the generally excellent quality and purity of American drinking water, the confectioner's water source is seldom a problem; however, due to variations in pH and mineral content in water from different sources, a disparity in results can occur from one location to another.

confectionery equipment

Confectionery is a highly specialized discipline that requires the use of appropriate equipment, some of which is not commonly found in pastry kitchens. Precisely what equipment a confectioner requires will depend on the size of the operation and the types of confections being produced: A hard candy operation will require entirely different facilities and equipment from those of a confectioner who mainly makes and enrobes ganache centers. Making confections as part of a hotel's pastry shop will require different equipment from that of a wholesale shell-molding operation.

The general tool requirements are listed in the paragraphs that follow. They are given in tiers, from the most basic requirements in tier one, to automated production equipment in tier three.

Tier one

The tools and equipment in tier one are intended for the production of relatively small batches of the wide range of confections represented in this book, such as might be produced in a restaurant, hotel, or catering operation.

Climate control system: A climate-controlled environment is quite possibly the most fundamental element of the confectionery process. Temperature must be controllable and humidity must be kept to a minimum for all confectionery, including chocolate and sugar work.

Scale: Accuracy in scaling is essential to confectionery success. A digital scale that reads in single-gram increments and will also display American units is recommended. A scale with a capacity of 5 kg is adequate for production of small batches of confectionery.

Stone slab: A marble, granite, or other nonporous stone slab is vital for drawing the heat out of sugar confectionery, and for chocolate work. Stone is ideal for its heat conductivity and thermal mass; it quickly draws heat out of substances without becoming significantly warm itself. To possess the best thermal mass properties, the stone for confectionery use should be as thick as possible, and it should be large enough to easily hold the largest batch size made in the shop.

LOCKWISE FROM TOP LEFT: *silicone mat stencil, caramel cutter, dipping tools, efractometer, infrared thermometer, praline cutters, confectionery frames*

Chocolate melters: Having a supply of melted chocolate on hand saves much valuable time. A variety of melters are available. The most important factors in choosing one are temperature control and capacity. The right melter should be able to accurately control the temperature for proper melting and maintaining crucial temperature of different types of

Hand tools: A selection of basic hand tools for stirring, cutting, and working with chocolate—scrapers, spoons, brushes, knives, palette knives, and so on—is required for basic confectionery production. Plastic stirrers are preferable to wooden implements because they do not harbor moisture or bacteria.

Confectionery frames: Metal bars of varying thicknesses or one-piece frames are used for slabbing (i.e., spreading) centers on stone slab. The formulas in this work are made using 12" metal bars of three thicknesses: ¼", ⅜", and ½". Other sizes may be used to achieve confections of different thicknesses, but the formula yields may require adjustment. In addition to the frames used for slabbing centers, a larger set of bars surrounding the stone table can be helpful for containing larger batches of hot mixtures, such as fudge or hard candy, as they cool on the stone.

Plexiglas sheets: 3/16" Plexiglas sheets of 12"x16" are convenient flat surfaces on which to place just-dipped confections to crystallize. They are also useful for slabbing ganache, allowing portability as the ganache crystallizes, and for transporting and handling other slabs of centers.

Mixers: Depending on the confections, and the batch sizes, 5 qt, 12 qt, or 20 qt and larger planetary mixers are valuable in confectionery, particularly for producing aerated confections such as nougat and marshmallow.

Food processor: A professional-grade food processor is indispensable for the production of small batches of marzipan and gianduja, as well as for the myriad other tasks it performs.

Standard gas stove: For small-scale production, a professional output gas stove is adequate for cooking batches of confectionery.

Standard cookware: Small batches of confections do not require special cookware; standard stainless-steel saucepans are adequate for the job. Untreated aluminum is unacceptable because it can catalyze the inversion of sugar, resulting in excessively soft candies.

Thermometers: Digital thermocouples are the most useful all-around thermometers, as they can be used both for high-temperature sugar boiling and for chocolate and ganache. Alcohol-filled glass thermometers are reliable instruments that never run low on batteries, but separate thermometers are required for different temperature ranges. Bimetal thermometers are slower to react, and are not as accurate as thermocouple technology. Surface-reading infrared thermometers are excellent for monitoring the temperature of chocolate. When relying on thermometers for determining the temperature of sugar confectionery, such as hard candies, fudge, and caramels, the same thermometer should be used each time; small differences between individual thermometers can cause inconsistent results.

Stainless-steel bowls: An assortment of bowls for mixing ingredients and working with chocolate is mandatory in the confectionery shop.

Polycarbonate chocolate molds: These durable plastic molds are available in many styles for producing shell-molded confections.

Tier two

Used together with the tier one tools, these tools will assist the confectioner in producing any of the confections in this book more expeditiously, and will allow for more efficient work and the production of larger batches.

Refractometer: This tool measures the sugar content of syrups. It is valuable for use in candying fruit and producing jellies, as it can determine the solids content to ensure consistency from batch to batch. A refractometer is a superior instrument to a saccharometer, hydrometer, or other densimeter for this purpose.

Guitar: Also known as a confectionery cutter, a guitar cuts ganache, jellies, marzipan, and other softer centers quickly and perfectly.

Panning machine: This machine is essential for producing any of the panned items discussed in this book, such as chocolate-coated nuts, and dried fruits.

Caramel cutter: This rolling cutter has multiple wheels for cutting caramel and other sugar confectionery into squares.

Heat gun: A heat gun such as those used for removing paint is valuable for maintaining the temperature of tempered chocolate and for warming molds.

Immersion blender: An immersion blender can be used to restore separated ganache, agitate chocolate for tempering, and remove lumps from mixtures.

Upgraded food processor: Larger, more powerful processors, some with vacuum pumps, are helpful when making larger quantities of better-quality marzipan and gianduja, and in emulsifying ganache.

Praliné cutters: These specialized tools are used to cut shapes from a precoated slab of center, such as marzipan. They are sold in sets of six, with various shapes included.

Shell-molding machine: Several hand-operated machines are available to fill chocolate molds and thus increase efficiency.

Tempering machine: A wide range of tempering machines is available, from small tabletop units that temper only 1 kilo of chocolate, to units that continuously temper hundreds of kilos. For larger-scale confectionery shops, a larger tempering machine greatly streamlines production.

Vacuum-packaging equipment: This equipment prepares confections for prolonged storage in the freezer.

Storage freezer: When proper procedures are followed, a freezer permits longer storage of confections in anticipation for the busiest seasons.

Spray gun: A spray gun can be used to spray chocolate for decorative purposes, or to bottom large numbers of individual centers at a time. Some spray guns rely on a separate compressor; others generate their own pressure.

Candy stove: For larger-scale sugar confectionery, a candy stove is indispensable. Candy stoves have tremendous output of heat, and are designed for rapid and efficient heat transfer when used with candy kettles. Fast cooking not only makes a confectionery operation more profitable, but also prevents excessive inversion and Maillard browning.

Candy kettles: Copper kettles with rounded bottoms that are designed to fit into candy stoves greatly increase the efficiency of cooking. The copper conducts heat extremely well, the rounded bottom provides the maximum surface area for heat transfer, and the large surface area ensures the most rapid evaporation of water. Care must be taken not to cook anything in these untreated kettles that could react with the copper and form toxins.

Tier three

This equipment allows the artisan confectioner to produce greater quantities with greater accuracy and speed, for increased volume and profitability. Machinery is available to handle virtually every aspect of any type of candy production, with greatly increased output.

Enrober with cooling tunnel: Nothing increases production capacity like an enrober. This machine eliminates the need for hand-dipping and greatly enhances production. Properly set up cooling tunnels ensure perfect crystallization of the chocolate surrounding the centers.

Water activity meter: This unit is especially important if the products being made are ganache, marzipan, or other high-moisture centers. A water activity meter allows the confectioner to adjust formulas for maximum shelf life, and for compatibility when two or more types of centers are combined in one confection.

Refiner/mélangeur: Two-roller refiners can be used to make excellent-quality marzipan and gianduja in large quantities.

Production machinery: A world of equipment is available for the confectionery manufacturer. The use of machinery for production exponentially increases the output of an operation. Any one of the following pieces of equipment for large-scale production of confectionery represents a substantial investment, and is intended for very specific production needs.

Fondant maker: This item beats cooked sugar into fondant and is intended for confectioners who require large quantities of fondant for use in centers.

Fire mixer: A mixer with a burner under the bowl is ideal for the production of caramels and other confections that require long cooking with constant stirring.

Vacuum cooker: A vacuum cooker removes water at lower temperatures than open cooking, and ensures rapid production and less caramelization in hard candies.

Depositor: This item portions large batches of centers to be enrobed.

Shell-molding equipment: Various parts of shell-molding production can be partially or fully automated for efficiency.

Batch warmers, pullers, sizers, cutters (hard candy): Every artisan hard candy production requires this equipment to be economically viable.

Packaging equipment: This is particularly important for individual pieces such as unenrobed caramels, hard candy, and taffy. Packaging equipment helps to present and preserve confections.