Unit III - Topic 2

Brewing-decaffeination

BREWING PROCESS

Coffee can be brewed in several different ways, but these methods fall into four main groups depending on how the water is introduced to the coffee grounds: decoction (through boiling), infusion (through steeping), gravitational feed (used with percolators and in drip brewing), or pressurised percolation (as with espresso).

Brewed coffee, if kept hot, will deteriorate rapidly in flavor, and reheating such coffee tends to give it a "muddy" flavour, as some compounds that impart flavor to coffee are destroyed if this is done. Even at room temperature, deterioration will occur; however, if kept in an oxygen-free environment it can last almost indefinitely at room temperature, and sealed containers of brewed coffee are sometimes commercially available in food stores in America or Europe, with refrigerated bottled coffee drinks being commonly available at convenience stores and grocery stores in the United States. Canned coffee is particularly popular in Japan and South Korea.

Electronic coffee makers boil the water and brew the infusion with little human assistance and sometimes according to a timer. Some such devices also grind the beans automatically before brewing.

The French press is considered one of the oldest and simplest methods to brew coffee[by whom?]. Despite its simplicity, it can be a little tricky.

Boiling

Boiling, or decoction, was the main method used for brewing coffee until the 1930s and is still used in some Nordic and Middle Eastern countries. The aromatic oils in coffee are released at 96 °C (205 °F), which is just below boiling, while the bitter acids are released when the water has reached boiling point.

The simplest method is to put the ground coffee in a cup, pour hot water over it and let cool while the grounds sink to the bottom. This is a traditional method for making a cup of coffee that is still used in parts of Indonesia. This method, known as "mud coffee" in the Middle East owing to an extremely fine grind that results in a mud-like sludge at the bottom of the cup, allows for extremely simple preparation, but drinkers then have to be careful if they want to avoid drinking grounds either from this layer or floating at the surface of the coffee, which can be avoided by dribbling cold water onto the "floaters" from the back of a spoon. If the coffee beans are not ground finely enough, the grounds do not sink.

"Cowboy coffee" is made by heating coarse grounds with water in a pot, letting the grounds settle and pouring off the liquid to drink, sometimes filtering it to remove fine grounds. While the name suggests that this method was used by cowboys, presumably on the trail around a campfire, it is used by others; some people prefer this method.

The above methods are sometimes used with hot milk instead of water.

Turkish coffee (aka Arabic coffee, etc.), a very early method of making coffee, is used in the Middle East, North Africa, East Africa, Turkey, Greece, the Balkans, and Russia. Very finely ground coffee, optionally sugar, and water are placed in a narrow-topped pot, called an cezve (Turkish), kanaka (Egyptian), briki (Greek), džezva (Štokavian) or turka (Russian) and brought to the boil then immediately removed from the heat. It may be very briefly brought to the boil two or three times. Turkish coffee is sometimes flavored with cardamom, particularly in Arab countries. The resulting strong coffee, with foam on the top and a thick layer of grounds at the bottom, is drunk from small cups.

Steeping

A cafetière, or French press, is a tall, narrow cylinder with a plunger that includes a metal or nylon fine mesh filter. The grounds are placed in the cylinder, and off-the-boil water is then poured into it. The coffee and hot water are left in the cylinder for a few minutes (typically 4–7 minutes) and then the plunger is gently pushed down, leaving the filter immediately above the grounds, allowing the coffee to be poured out while the filter retains the grounds. Depending on

the type of filter, it is important to pay attention to the grind of the coffee beans, though a rather coarse grind is almost always called for.A plain glass cylinder may be used, or a vacuum flask arrangement to keep the coffee hot; this is not to be confused with a vacuum brewer—see below.
Coffee bags are used less often than tea bags. They are simply disposable bags containing coffee; the grounds do not exit the bag as it mixes with the water, so no extra filtering is required.
Malaysian and some Caribbean and South American styles of coffee are often brewed using a "sock," which is actually a simple muslin bag, shaped like a filter, into which coffee is loaded, then steeped in hot water. This method is especially suitable for use with local-brew coffees in Malaysia, primarily of the varieties Robusta and Liberica which are often strong-flavored, allowing the ground coffee in the sock to be reused.

A vacuum brewer consists of two chambers: a pot below, atop which is set a bowl or funnel with its siphon descending nearly to the bottom of the pot. The bottom of the bowl is blocked by a filter of glass, cloth or plastic, and the bowl and pot are joined by a gasket that forms a tight seal. Water is placed in the pot, the coffee grounds are placed in the bowl, and the whole apparatus is set over a burner. As the water heats, it is forced by the increasing vapor pressure up the siphon and into the bowl where it mixes with the grounds. When all the water possible has been forced into the bowl the infusion is allowed to sit for some time before the brewer is removed from the heat. As the water vapor in the lower pot cools, it contracts, forming a partial vacuum and drawing the coffee down through the filter.

Decaffeination

Decaffeination is the removal of caffeine from coffee beans, cocoa, tea leaves, and other caffeine-containing materials. Decaffeinated drinks contain typically 1–2% of the original caffeine content, and sometimes as much as 20%.[1] Decaffeinated products are commonly termed decaf.

Direct method

The first commercially successful decaffeination process was invented by German merchant Ludwig Roselius and co-workers in 1903, after Roselius observed that a consignment of coffee beans accidentally soaked in sea water had lost most of their caffeine content without losing much of their flavour. The process was patented in 1906, and involved steaming coffee beans with various acids or bases, then using benzene as a solvent to remove the caffeine. Coffee decaffeinated this way was sold as Kaffee HAG after the company name *Kaffee Handels-Aktien-Gesellschaft* (Coffee Trading Company) in most of Europe, as *Café Sanka* in France and later as Sanka brand coffee in the US. Café HAG and Sanka are now worldwide brands of Kraft Foods.

Methods similar to those first developed by Roselius have continued to dominate, and are sometimes known as the *direct organic solvent method*. However, because of health concerns regarding benzene (which is recognized today as a carcinogen), other solvents, such as dichloromethane or ethyl acetate, are now used The not roasted (green) beans are first steamed and then rinsed with the solvent which extracts the caffeine, while leaving other constituents largely unaffected. The process is repeated from 8 to 12 times until the caffeine content meets the required standard (97% of caffeine removed according to the US standard, or 99.9% caffeine-free by mass per the EU standard).

Indirect method

Another variation of Roselius' method is the *indirect organic solvent method*. In this method, instead of treating the beans directly, they are first soaked in hot water for several hours, then removed. The remaining water is treated with solvents (e.g. dichloromethane or ethyl acetate) to extract the caffeine from the water. As in other methods, the caffeine can then be separated from the organic solvent by simple evaporation. The same water is recycled through this two-step process with new batches of beans. An equilibrium is reached after several cycles, wherein the water and the beans have a similar

composition except for the caffeine. After this point, the caffeine is the only material removed from the beans, so no coffee strength or other flavorings are lost.[10] Because water is used in the initial phase of this process, indirect method decaffeination is sometimes referred to as "water-processed". This method was first mentioned in 1941, and people have made great efforts to make the process more "natural" and a true water-based process by finding ways to process the caffeine out of the water in ways that circumvents the use of organic solvents

The conventional decaffeination process can be divided into four major steps:

1) Steaming the beans,
2) Extracting caffeine with an organic solvent,
3) Driving off the solvent by steam to a tolerate level,
4) Drying the coffee beans

Swiss Water process

Sack of green coffee beans decaffeinated by the Swiss Water process. An alternative method for removal of caffeine from coffee is the Swiss Water process. This process uses no organic solvents, and instead only water is used to decaffeinate beans, a technique first developed in Switzerland in 1933, and commercialized by Coffex S.A. in 1980. The Swiss Water process was then introduced by The Swiss Water Decaffeinated Coffee Company of Burnaby, British Columbia, Canada, in 1988.

The process uses green coffee extract (GCE) for the caffeine extraction mechanism. Green coffee extract is a solution containing the water-soluble components of green coffee except for the caffeine, obtained by soaking green coffee beans in hot water, then filtering through an activated charcoal filter to remove the caffeine molecules.Fresh beans containing both caffeine and the other components are added to the GCE solution, where the gradient pressure difference between the GCE (which is caffeine-lean) and the green coffee (which is caffeine-rich) causes the caffeine molecules to migrate from the green coffee into the GCE. Because GCE is saturated with the other water-soluble components of green coffee, only the caffeine molecule migrates to the GCE; the other water-soluble coffee elements are retained in the green coffee. The newly caffeine-rich GCE solution is then passed through the activated carbon filters to remove the caffeine again, and the process is repeated. The continuous batch process takes 8–10 hours to meet the final residual decaffeinated target.Noted food engineer Torunn Atteraas Garin also developed a process to remove caffeine from coffee.

Triglyceride process

Green coffee beans are soaked in a hot water/coffee solution to draw the caffeine to the surface of the beans. Next, the beans are transferred to another container and immersed in coffee oils that were obtained from spent coffee grounds and left to soak.

After several hours of high temperatures, the triglycerides in the oils remove the caffeine, but not the flavor elements, from the beans. The beans are separated from the oils and dried. The caffeine is removed from the oils, which are reused to decaffeinate another batch of beans. This is a direct-contact method of decaffeination.

Supercritical CO2 process

Food scientists have also turned to supercritical carbon dioxide (sCO2) as a means of decaffeination. Developed by Kurt Zosel, a scientist of the Max Planck Institute, it uses CO2 (carbon dioxide), heated and pressurised above its critical point, to extract caffeine.[5] Green coffee beans are steamed and then added to a high pressure vessel. A mixture of water and CO2 is circulated through the vessel at 300 atm and 65 °C (149 °F). At this pressure and temperature CO2 is a

supercritical fluid, with properties midway between a gas and a liquid. Caffeine dissolves into the CO2; but compounds contributing to the flavour of the brewed coffee are largely insoluble in CO2 and remain in the bean. In a separate vessel, caffeine is scrubbed from the CO2 with additional water. The CO2 is then recirculated to the pressure vessel.