



Deconstructing Decaf

DECAFFEINATION PROCESSES EXPLAINED

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AS WE ALL KNOW, roasters love to talk about the intricacies of specialty coffee. Whether the subject is favorite origins, roasting techniques or extraction methods, conversations can go on for hours. But mention decaffeinated coffee, and roasters suddenly begin to qualify their comments with statements like, “I’m no expert, but ...” Or they discuss decaf as a necessary evil. Or even clam up entirely.

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PHOTO COURTESY OF DESCAMEX

It behooves roasters and retailers to learn more about decaffeination processes and sourcing quality decaf coffee—not only to increase their own coffee knowledge and confidence, but also to market decaf to an ever-expanding customer base.

Why the reticence to confidently discuss decaf? For one, decaf often makes up less than 10 percent of roasters' offerings, so they may not feel as well versed in selecting and roasting decaffeinated beans. For another, decaf has weathered a fair amount of flak over the years due to a perception of poor flavor or the old rumor that coffee was decaffeinated using formaldehyde—and the view that it's the drink of choice of the older generation or people on medication. Simply put, decaf is "not where the sex appeal is," says Jacob Bodden, owner of Bica Coffeehouse in Oakland, Calif., where decaf coffee totals only about 3 percent of sales. Most roasters offer several blends and a selection of single-origins, but only one decaf coffee.

At the same time, the market for decaf is projected to increase in the coming years as the population ages. As *The New York Times* recently reported, the oldest baby boomers will turn 65 this year. And, as more coffee drinkers get hooked on decaf for health reasons, "unleaded" coffee seems poised for a reawakening. But if—and only if—roasters offer quality decaf coffee that tastes good.

"Throughout the years, many roasters offered their regular coffee at the same price as decaf, and they were using lower-quality [beans]," explains Demetrio Arandia Muguira, president of Descamex, which operates two decaffeination plants in Veracruz, Mexico. "We are strong believers that good-quality decaf will end up increasing consumption ... and benefit all the different parts of the supply chain."

Consumers who drink both regular and decaffeinated coffee are driving the push toward better-quality decaf, says David Kastle, vice president for trading at Swiss Water Decaffeinated Coffee Company, based in Burnaby, British Columbia. "As specialty coffee has matured, and quality coffee and roasting and preparation of coffee have improved, 'dual drinkers' are drinking regular coffee and they're

drinking decaf," Kastle says. "They're very cognizant of times when the decaf is not up to the caliber of the regular coffee."

So it behooves roasters and retailers to learn more about decaffeination processes and sourcing quality decaf coffee—not only to increase their own coffee knowledge and confidence, but also to market decaf to an ever-expanding customer base (see sidebar on page 42 for more on strategies for selling decaf). Here's a primer covering the methods available for decaffeinating beans, followed by tips from roasters on selecting and roasting decaffeinated coffee.

Conventional, direct-extraction processes: Methylene chloride and ethyl acetate

Methylene chloride and ethyl acetate are the two solvents traditionally used to extract caffeine from coffee beans. Worldwide, methylene chloride is the most commonly used decaffeination process, says Muguira of Descamex, which offers methylene chloride-based decaffeination at one of its plants.

Both solvent-based extraction methods use similar steps to achieve decaffeination, says Joseph A. Rivera, founder of www.coffeechemistry.com. "The first step, regardless of what method you use, is you soak the beans in hot water or steam them, which swells up the beans and increases the surface area," he explains. "That way, the chemical can penetrate the bean."

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Interior of decaffeination plant.

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Next, the coffee goes into a solvent-filled vat, which Rivera likens to a washing machine. “You just stir it up for a few hours,” says Rivera, a frequent conference presenter about decaf methods and the former director of science and technology for the Specialty Coffee Association of America.

Because methylene chloride and ethyl acetate are selective compounds, they will bond with the caffeine molecules and leave the flavor compounds inside the beans alone, Rivera says. According to U.S. guidelines, 97.5 percent of the beans’ caffeine must be removed to label the coffee as decaffeinated.

Though methylene chloride is the more popular solvent-based decaf process, ethyl acetate is also available as a decaffeinating agent. Sweet-smelling ethyl acetate is a naturally occurring compound, but “there are no scientists going out and collecting little bits of it from flowers. They buy 50-gallon drums of it,” Rivera says. “The driving factor” for using ethyl acetate, he adds, “is that you can say it’s all natural.”

Once the solvent has been siphoned away, the last step is to remove the solvent from the beans themselves. “Methylene chloride is volatile like acetone, [which] you use to remove nail polish,” Rivera says. To evaporate either solvent from the batch of beans, the coffee is steamed. “The boiling point of methylene chloride is 104 degrees Fahrenheit, and ethyl acetate is 171 degrees,” Rivera continues. “So in the final stage when you dry it off, you may have to steam [beans decaffeinated with ethyl acetate] a little longer because

it boils at a little higher temperature.”

The end result? Decaffeinated, green coffee with a solvent residue of only about 1 part per million. The U.S. Food and Drug Administration, Rivera notes, allows for a residue of 10 parts per million, which means that the decaffeinated coffee contains about one-tenth of the legal limit.

As a second revenue stream, the decaffeination plants using these traditional methods can separate the caffeine from the solvents and sell the caffeine to other businesses (pharmaceutical and soft drink manufacturers, for example), making these processes less expensive.

▶ Water-based processes

Water-based processes rely on the principle that coffee is only 24 to 26 percent soluble in water. To prepare to decaffeinate coffee via a water-based method, a solution is created by soaking a huge quantity of arabica beans in water until all of the soluble components, including caffeine, seep out of the beans. The spent beans are then discarded, and the fluid passes through carbon filters that extract the caffeine. The resulting fluid is saturated with water-soluble solids, minus the caffeine.

Swiss Water Decaffeinated Coffee Company calls this fluid “green coffee extract,” or GCE. Descamex has also developed a fluid

saturated with coffee components to use in its Mountain Water Process.

To prepare coffee for either of these water-based decaffeination processes, coffee is first rehydrated in water. Decaffeination companies then soak batches of beans in the concentrated fluid. “The extraction takes place under special conditions of flow, pressure, temperature and vacuum,” says Muguira of Descamex.

When decaffeinating with water-based methods, caffeine is the only substance preventing the beans and fluid from reaching equilibrium—so the beans do not release their flavor, but the caffeine migrates into the water. At the same time, carbon filters pull the caffeine out of the solution. The process continues until the beans reach the targeted caffeine content.

At Swiss Water Decaf, the coffee mingles with the green coffee extract for eight to 10 hours during which a proprietary carbon filtering system removes the caffeine, says Kastle. (For more detail about this process, visit www.swisswater.com/video.)

After drying and a phase for resting, the coffee is now ready to be bagged and shipped. But what happens to the caffeine? Extracting the caffeine from the carbon filters and selling it would require applying a chemical such as methylene chloride, Kastle explains, but as Swiss Water Process is 100 percent chemical-free and organic, the company uses a furnace to burn off the caffeine.

PHOTO COURTESY OF DESCAMEX



▶ Super-critical carbon dioxide process

Though we typically think of carbon dioxide as a gas, it turns into a liquid when it’s compressed. To decaffeinate with this super-critical carbon dioxide, the beans are first soaked in hot water. Then, inside a compression tower, the beans are added to a mixture of water and carbon dioxide at a pressure of more than 3,500 psig, or pound-force per square inch gauge. (By comparison, car tires are inflated to a pressure of about 35 psig, and a standard air compressor for household use operates at less than 100 psig.) This tremendous

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amount of pressure transforms the carbon dioxide into a super-critical state, in which it's partly a gas and partly a liquid.

Inside the pressurized tower, the carbon dioxide bonds to the caffeine, while leaving the flavor compounds inside the beans. After the beans have been decaffeinated, the coffee is moved from the compression tower to a dryer, and then on to be packaged and shipped.

When the carbon dioxide/water mixture is depressurized, the carbon dioxide returns to a gaseous state and discharges the caffeine into the water. The carbon dioxide is reused to decaffeinate later batches of coffee, while the water is filtered to remove the caffeine for resale.

Carbon dioxide decaffeination is a higher-cost process because it requires an investment in heavy-duty equipment for pressurization and monitoring, as well as high energy expenditures to operate the decaffeination tanks at the forces needed to compress the gas.

Views on decaf from the roastery

Now that we've examined the technical side of decaf processing, let's look at the perspectives of roasters and retailers who work with decaffeinated coffee every day. What are their thoughts on the price and roasting challenges inherent to decaf coffee? And, most importantly, what are the results in the cup?

Price

Coffees travel from origin to a warehouse before being shipped to the roaster. Many decaffeinated coffees take an additional journey to the decaffeination plant, where they undergo an extra process before being shipped to an importer's warehouse or direct to a roaster. Decaffeination plants are scattered across the globe, with most located outside the United States. Due to the added shipping, handling and processing, decaffeinated coffee may very well be the most expensive beans that roasters purchase.

Adding to the overall cost is the fact that decaffeination works with large batches of coffee—at least 50 to 100 bags of coffee—so only high-volume national and regional roasters can afford to deal directly with



decaffeination companies. Importers typically place decaffeination orders and offer the coffee for sale to roasters in need of smaller quantities. Of course, whenever coffee is segmented into smaller portions, the price per pound increases.

"Coffee prices are going crazy these days, but generally we have found decaf to cost us at least 50 percent more than our regular beans," says roaster Matt Hensley of 35 North Coffee Co. in Franklin, Tenn., which purchases mainly water-processed decafs. For 35 North, however, quality is the driving factor in choosing a decaf coffee.

Coffees decaffeinated with water-based and carbon dioxide processes fetch a higher price due to their exclusivity, says Donald Schoenholt, president of Gillies Coffee Company in New York. "Methylene chloride decaffeinated is produced in quantity by many, providing a market that keeps the price competitively value oriented," Schoenholt says. Many methylene chloride decafs are designated for the mass market and blended to be price-competitive.

However, roasters who offer organic coffee cannot use the traditional methylene chloride or ethyl acetate methods if they seek to comply with USDA organic standards for their decaf. Coffees decaffeinated with a water-based process or via carbon dioxide retain organic certification because chemicals are not used.

"Generally, the water-processed coffees are significantly more expensive than the

other methods, and as a result we tend to offer these at a premium. The main reason for me to purchase these is to maintain organic status on certain blends," adds buyer and roaster Caleb Mayhall of Chicago's Metropolis Coffee Company.

Roasting

The conventional wisdom is that decafs are more challenging to roast. To start out with, the coffee comes to the roastery tinted a darker shade than regular green coffee.

"Some people find it more difficult to roast decaf if they are roasting based on bean color," says Hensley. "We profile based on how far after the first or second crack we pull a bean. For decaf, this eliminates the bean color issue altogether."

Decaf coffee is sometimes over- or under-roasted because the darker original color of the green coffee changes the roaster operator's perception of bean development through first crack, says Mayhall. "Overall, I have found a lower [roasting] temperature is required, especially on water-process coffee," Mayhall adds. "Less reliance on visual landmarks and more attention to the environment temperature, as well as a keen sense of the intensity and frequency of the first crack, are key."

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But Kastle of Swiss Water Decaf says he doesn't "baby" his decaf coffee during the roasting process. "I don't change profiles anymore because I want to see if there's any performance difference between the pre- and post-decaffeination," he says. "In most cases, for washed Latin coffees, I'm seeing a variation so slight that it could be minor airflow differences."

Schoenholt says he doesn't find roasting decafs as challenging as single-origins such as Ethiopian Harrar. "Decaffeinating changes the color of the beans and removes some waxes and other material, so decaffeinated beans need a little practice to get used to," Schoenholt says, "but once you roast them up a few times, you have learned what to expect from the beans, and you are prepared to coax them through the process to where you want them to be."

Roasters shouldn't confuse roasting difficulty with simply paying attention to their beans, adds Terry V. Patano, roaster and owner of DOMA Coffee Roasting Company in Post Falls, Idaho. "If roasters put the same attention into their decaf as they do their other coffees, the world would have a lot more better-tasting decafs," Patano says.

Results in the Cup

In many ways, decaf coffee is still saddled with baggage from years ago, when only poor-quality coffee was decaffeinated and it was nearly impossible to find a decaf that tasted good. Today, those perceptions are changing, but those who roast decaf that's past its prime or purchase coffee that didn't taste good *before* decaffeination are asking for disappointment.

"For our plant, we're at a point that I'm very confident that if you get a good coffee in, you'll get a good decaf out," says Kastle of Swiss Water Decaf, who recommends roasting decaf beans within a month or two, just like regular coffee, to maintain peak freshness. "If you send us a really old, tired, baggy coffee, it's not going to magically turn into brand-new coffee. ... You take a not-great coffee in the door, and that's what you get out." Many importers and larger roasters take advantage

of toll decaffeination services, allowing them to send their own quality coffee beans to be processed rather than buying a pre-blended decaf.

Even so, roasters say that their decafs do not exhibit the same flavors that they taste in the caffeinated version of the bean. For one, caffeine is an acidic compound, so removing caffeine from the beans affects the acidity in the cup.

"From a cupper's perspective, all decaffeinated coffees knock a bit of coffee's natural acidity away, along with some other natural ingredients, which explains why decaffeinated produces a duller roast, and sometimes a duller cup than its nondecaffeinated brethren," Schoenholt says. "Still, decaffeinated has come a long way from the insipid, uninspiring and sometimes medicinal-tasting stuff that passed for decaffeinated 40 years ago."

Hensley, who confesses to trying decaf coffee for the first time after he started roasting it, enlisted his parents to give feedback on his roasts. Flavors are not as prominent in decaf coffees, he notes. "You can make decaf very smooth," Hensley says, "but you also lose a lot of those accent flavors that other coffees tend to have, like citrus, or nut flavors, or berry, or other fruity flavors that come out in a lot of regular coffees." However, manipulation of roast, grind and dosage can counteract the milder flavor of the beans.

Bodden of Bica has been drinking decaf for years and points to two other factors that affect his perception of decaf. "First of all, it's usually roasted quite dark, and we prefer much lighter roasts," he says. "Second of all, there just is not the selection from which to choose. [The roasters I purchase from] ... oftentimes have two decaf blends, and sometimes have a single-origin decaf; I will always opt for the single-origin because it becomes more than just 'decaf.'"

When selecting decaf coffees for their lineup, some roasters prefer to stick with coffees processed via a single method, while others experiment with all types. Bica, DOMA and 35 North are loyal to water-based processes due to a combination of taste, organic certification and health reasons. Gillies and Metropolis, on the other

hand, work with coffees decaffeinated with a variety of methods.

"Each method of decaffeination has a unique effect on the flavor of the coffee, and I don't generally seek out one in particular," says Mayhall of Metropolis, who says he purchases based on results in the cup. "Personally, I have found that the methylene chloride typically affects the flavor of the coffee less than other methods but can leave a slight chemical odor," he adds. "Water-process coffees tend to exhibit a unique sourness and can be tricky to roast, and the ethyl acetate process sometimes completely changes the balance of sweetness, amplifying it or giving it an artificial quality."

Early this year, Mayhall took his decaf experimentation one step further: He approved a nondecaffeinated green sample of a Kenya prior to decaffeination.

In addition to the quality of the coffee, Mayhall says the lower freight costs for decaffeination at a plant in the United States played into his choice. The decision was "a big change for me in recent years, approving the coffee before decaffeination," he says. "Really, I don't think that would have happened for a small company 10 years ago."

Mayhall's decision reflects a growing comfort with decaf coffee—from purchasing to roasting to serving the coffee to the consumer—and maybe even a shot of confidence.

"I think we could fool a lot of 'core' espresso drinkers with our decaf—and on occasion I do!" says Patano of DOMA. "There are some really good decafs out there. Don't give up if you haven't found one. Roasters [should] take the time and care you would with your other coffees—you have a lot of customers who will appreciate it."

DECAF AS A PRODUCT CATEGORY
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DECAFFEINATED COFFEE as a Product Category (NOT A NECESSARY EVIL)

BY RUTH ANN CHURCH

“HOW MANY of your customers buy decaf?” It seems like an obvious question, but some roasters are surprised by their answer. They begin by saying, “Hardly any; it’s a very small part of our business.” They’re right, of course. Decaf usually comprises only 5 to 25 percent of any roaster’s volume. But the question, stated more specifically, is, “Thinking about your wholesale business, what percent of your customers are buying decaf from you?” After a pause, the answer is usually, “Well, it’s 100 percent.”

The realization that decaf is the only other product after regular coffee that nearly every customer needs at some point can drive a whole new perspective on decaffeinated coffee. It’s a unique product category in the roaster’s product mix. Let’s look at what it means to consider decaf coffee as just that—a product category, not a “necessary evil.” Like other product categories, one of the most important aspects to evaluate is whether it’s making money for you.

TABLE ONE

PRODUCT CATEGORIES

ROASTER	% of sales
Regular coffee and regular espresso	80%
Decaf coffee and decaf espresso	10%
Syrups	5%
Teas	5%
Total	100%
Fair-trade coffees	3%
Organic coffees	5%

TABLE TWO

WHAT VALUED PRODUCT SEGMENTS GET

- Careful sourcing
- Quality checks
- Sales team educated about the product
- A place on the menu
- Promotional marketing
- Prime placement (on shelf, in store, etc.)
- Sustainable pricing

Product Category Review

Savvy business owners know which product categories are making money and which aren’t, and they have sound reasons for each case. So the roaster’s initial step with decaf is to evaluate its current status among all of the product categories. With this baseline, the roaster can decide if the status quo is acceptable (and it may very well be), or the roaster may determine that there’s a missed opportunity to add profits, improve quality consistency and retain loyal customers. It’s hard to find good decaf coffee, so when a consumer finds good decaf, they typically become loyal.

Tables 1 and 2 show an example lineup of product categories and the types of work one would do for the product categories that are driving profits. Replace the numbers in Table 1 with your own. For each line, consider whether that category is profitable or not, and how confident you are about your answer. If decaf isn’t making money, or you’re not sure if it is, you get to decide if it’s worth doing anything about it.

To help you decide, you could review the items in Table 2 and determine whether any of them have resulted in improved sales for

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other categories. For example, what actions have helped sales of your highest-margin coffees? Have cuppings or other means of educating customers ever boosted revenue for a small category that was lagging?

Quality Compromised for Price

All of the items in Table 2 are important, but the last one, pricing, is particularly critical and too often ignored when it comes to decaf. What appears to happen commonly is a “not thinking about it” pricing method. There’s a pervasive assumption that the per-pound or per-cup price to customers must match the regular coffee price.

This assumption almost always forces a quality compromise. Decaffeination is an added cost requiring additional transportation. Plus, decaf is purchased in smaller quantities than regular coffee. If the end user is asked to pay the same price they pay for regular, the business owner can maintain margins only by buying a quality level of decaf that is significantly lower than that of the regular coffee the business serves.

Enlightened Decaf Pricing Model

This quality compromise is avoided by pricing decaf separately from regular coffee and applying a cost-plus-margin approach to both. In this model, a high-quality regular coffee might cost \$3.50 per pound and a decaf of equal quality might cost \$4 per pound. By adding the business’s required margin of 40 percent to each base cost, the resulting prices are \$4.90 per pound for regular and \$5.60 per pound for decaf (see Table 3).

With this model, quality and those who value it win. “Decaffeinated coffee costs more,” says Brett Struwe, director of coffee operations at Caribou Coffee in Minneapolis. “We believe Caribou customers care about quality and taste, so we put it out there.” About six years ago, Caribou made the bold move of shifting its entire decaf coffee line to water-processed decaf coffees. At the same time, the company implemented a plus-\$.10 per cup and a plus-\$1 per pound price markup that’s plainly listed on every menu board.

“It’s successful,” Struwe says, “or we wouldn’t still be doing it. We may not be getting as much of the overall decaf market, but our decaf customers are the high end. We communicate with them, and they understand the added value we offer.”

What Caribou and others have done is use marketing muscle to support the transition to higher-priced decaf coffees. At Caribou, customer service reps are trained to share colorful in-store booklets that describe the decaffeination process and how Caribou is paying attention to quality for the decaf segment. Other roasters use blind cuppings and store intercepts to promote the quality and taste of their decaf line up. One roaster/retailer welcomed a “moms’ club”

TABLE THREE
ENLIGHTENED DECAF PRICING

	Base cost per lb.	40% margin	Customer price per lb.
Regular coffee (meeting high-quality standard X)	\$3.50	+\$1.40	\$4.90
Decaf (meeting high-quality standard X)	\$4.00	+\$1.60	\$5.60

to his coffeehouse. It was an opportunity to share how good his decaf coffee is while also improving sales during an otherwise slow part of the day.

The Decaf Consumer

Marketing efforts raise the question, “Who is the decaf consumer?” There is a wealth of information about them available through industry associations, although it’s harder to find than one might think. The most striking demographic on decaf consumers is age. Decaf drinkers start to become a significant share of the coffee-drinking population in the over-35 range and take another noticeable step up to 25 percent market share in the 60-years-and-older range. According to the National Coffee Association, growth of the gourmet coffee market so far has been focused on the younger demographics, “a huge missed opportunity for the industry.”

Other industry professionals also lament the current overall lack of attention to the possibilities in decaf coffee. In the July 2010 edition of *Coffee Review*, Kenneth Davids wrote, “Perhaps some ... innovative roasting company needs to raise the bar for the specialty industry by putting more focus on decaffeinated coffees and in the process making some waves and some money with them.”

To give credit where credit is due, many roasters *are* offering high-quality decafs. They’re charging for it, and increasing numbers of decaf consumers are thanking them for their efforts with extra change at the cash register. These roasters refuse to compromise on their brand promise of “high-quality coffee”—especially when they know the product is one of only two items that 100 percent of their customers buy from them.

RUTH ANN CHURCH *drinks decaf coffee daily and is president and chief relationship officer of Artisan Coffee Imports, which specializes in providing great-tasting decaffeinated green coffee from all of the decaffeination processes. She can be reached at rachurch@artisancoffeeimports.com.*



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