How Coffee is Decaffeinated

Article Rating: NA

Submitted by: articlediner on 2007-02-06 and viewed 31 times.

Total Word Count: 953

Author Rating:

Sample of Content:

Explanations and descriptions of the different methods available for decaffeinating coffee, along with the advantages and disadvantages of each.

Content:

First, let's start with a really quick history. Coffee was first decaffeinated by Ludwig Roselius, a German coffee merchant, in 1905 after he received a coffee shipment that had gotten soaked during a storm at sea. He experimented with the brine-soaked coffee, and found out that benzene could be used as solvent to bond with the caffeine. Since caffeine is water-soluble at temperatures above 175Â°, he could boil the solution to separate the caffeine from the coffee. With his process, the coffee was decaffeinated, but it had lost much of its flavor.

For the record, Ludwig improved on his process and went on to sell his discovery under the Sanka brand name. Benzene is no longer used, as it is not considered safe for human consumption.

Today there are 3 commonly used methods available for removing caffeine from coffee, with dozens of variations of those methods. Two common variations are Direct and Indirect Method.

European or Traditional Process - Direct Method:

The direct process involves softening the beans by steam first, then washing them for about 10 hours with either a methylene chloride or ethyl acetate solution to absorb the caffeine from the bean. The solution is discarded, the beans are re-steamed to remove any remaining solvent (methylene chloride boils away at 114Â° ethyl acetate at 104Â°), then the beans are dried to their original moisture content.

European or Traditional Process - Indirect Method:

Instead of being steamed, the coffee beans are soaked in very hot water, which extracts the caffeine along with many of the oils. This solution is then treated with either methylene chloride or ethyl acetate, which bonds with the caffeine. Then the solution is heated to the temperature at which the caffeine and either methylene chloride or ethyl acetate compounds evaporate. The oils are then reintroduced to the beans, and the beans are then dried.

About 80% of decaf coffees are processed by the Traditional, or European Process, and many serious coffee drinkers believe this method makes for the best-tasting coffee. Others worry about the chemicals involved. Methylene chloride is considered a superior solvent since it can evaporate at a lower temperature and leaves virtually no trace in the beans, but it is an environmental hazard to workers at decaffeination plants, and it is known to harm the ozone layer. Ethyl acetate can be extracted from various fruits and vegetables and so it is considered a "naturally-found" chemical, but most ethyl acetate used for decaffeinating is synthethically produced.

The Water or Swiss Water Process:

Also known as the water process, this process uses no chemicals, but rather hot water, steam and osmosis to remove the caffeine from the coffee in two steps. In the first step, which is similar to the Traditional, Indirect Method, the beans are soaked in a hot water solution to remove the caffeine and the flavor oils. The beans used in this step are then discarded. The solution is run through activated charcoal filters to remove the caffeine, but leave the flavor oils. A new batch of beans is then soaked in the solution. According to the laws of osmosis, the caffeine leaves the beans to go to the uncaffeinated solution, but the flavor in both the solution and the beans is equal, so no flavor leaves the beans.

The beans are then dried and shipped to the roasters. The disadvantage is that the water processing removes more than just the caffeine. Some of the oils from the coffee bean are removed as well, making it less flavorful.

The Hypercritical Carbon Dioxide Method:

In this method, which is not as popular as the other methods, the beans are soaked in a solution of liquid carbon dioxide to remove the caffeine. The get to a liquid state, the carbon dioxide must be highly pressurized (73 to 300 atmospheres), which makes the logistic cost of this method a bit higher than the other methods. After the caffeine is absorbed by the carbon dioxide, either the pressure is reduced and carbon dioxide is allowed to evaporate, or the solution is run through a carbon filter to remove the caffeine. Although more expensive, the advantage of the Carbon Dioxide Method is that since carbon dioxide is not a harmful gas, the method is not harmful to health or the environment.

Other Methods:

Since there's no consensus best-way to remove caffeine from coffee beans, there are still new methods being developed.

One new method is the Triglyceride Process. In this method, green coffee beans are soaked in a solution or hot water and coffee to draw the caffeine to the surface of the beans. Then, the beans are transferred to another container and immersed in coffee flavor oils that were obtained from spent coffee grounds. The flavor oils contain triglycerides are a naturally-occurring combination of fatty acids and glycerol, and, after several hours at high temperatures, they are able to remove the caffeine from the beans while not affecting the flavor.

Another new method, and possibly the future of decaffeinated coffee, is the cultivation of Naturally Caffeine-Free Coffee from trees that have recently discovered in that produce coffee with no caffeine. Depending on the variety of coffee, the caffeine content already varies significantly, from about 75 mg to 250 mg per 6 oz. cup. Arabica coffee varieties normally contain about half the caffeine of robusta varieties, and dark roast coffee usually has less caffeine than lighter roasts since the roasting process reduces caffeine content of the bean. An arabica bean containing a tenth as much caffeine as a normal bean has been found, so the possibility of developing or finding a bean with no caffeine is probably a matter of time.

Paul Ballenger is a coffee lover and freelance writer. For more information on coffee makers, espresso machines and coffee please visit his web site.

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About the Author: