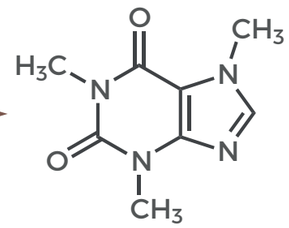
# THE CHEMISTRY OF DECAFFEINATED COFFEE

## COFFEE & CAFFEINE

A typical cup of coffee contains between 70 to 140 milligrams of caffeine. Caffeine can influence the central nervous system, and can lead to sleep problems, restlessness and discomfort.

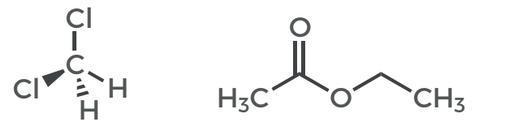
**CAFFEINE**



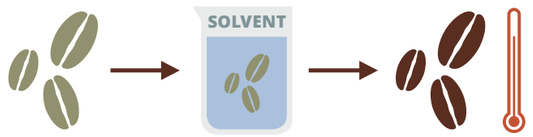

There are several processes used to decaffeinate coffee. In the U.S. decaffeination must remove 97% of the original caffeine content.

## SOLVENT DECAFFEINATION

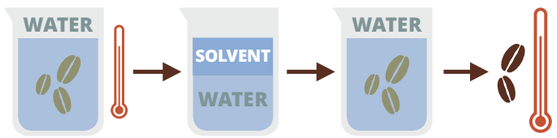
Solvent decaffeination uses solvents to selectively remove caffeine. Common solvents are methylene chloride and ethyl acetate.




*Methylene chloride (left) and ethyl acetate (right)*



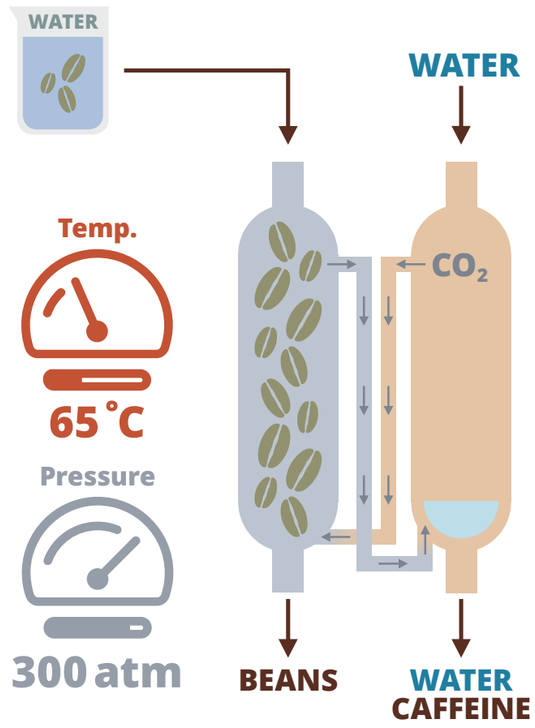

In direct solvent extraction (above) beans are steamed, then soaked in solvent to remove caffeine, before being steamed, dried, and roasted.




In indirect solvent extraction (above) beans are soaked in hot water. The water is then mixed with a solvent to remove caffeine, before flavours in the water are returned to the beans.

## $CO_2$ DECAFFEINATION

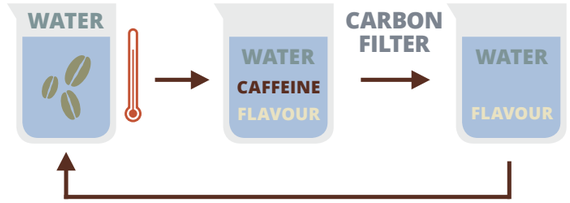
Solvent decaffeination removes caffeine but can also remove other flavour compounds or precursors. Carbon dioxide is more selective.




At high pressure carbon dioxide dissolves caffeine. The caffeine is removed from the carbon dioxide with water so it can be recirculated. The process lasts for up to 12 hours.

## WATER DECAFFEINATION

'Swiss water decaffeination' soaks beans in hot water to remove caffeine and flavour compounds. Caffeine is removed from the water by filtration but flavour compounds remain. The flavour-saturated water removes caffeine from further bean batches without flavour loss.




*Flavour-charged water used to remove caffeine from new batch of coffee beans*

'French water decaffeination' soaks beans in hot water for 24 hours. The beans are removed and dried, and the water is filtered to remove caffeine. The caffeine-free water is added to the dried beans so that they reabsorb flavour compounds.