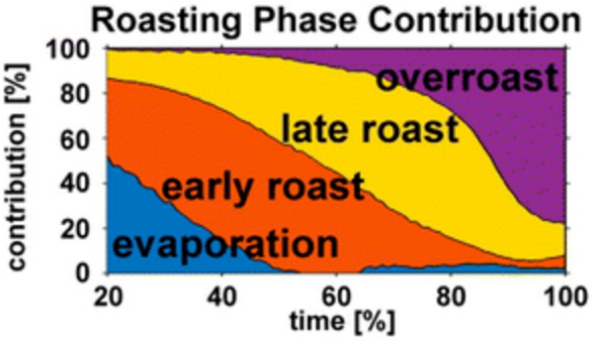
# Chemistry Can Help Roast the Perfect Coffee Bean

*By Alex Berezow — June 26, 2016*

[1] *Credit: Shutterstock*

Roasting coffee is more art than science. Under-roast the bean, and the chemical reactions necessary to produce its characteristic flavor and color do not occur at an adequate level; over-roast the bean, and the resulting brew is bitter. But, coffee producers and their customers are interested in consistency. Here, the tools of analytical chemistry come in handy. A group of primarily German researchers is attempting to make coffee roasting more science than art. The team's aim is to create a technique that would allow real-time monitoring of the coffee roasting process.




[2] *The phases of coffee roasting. (Credit: H. Czech et al., J. Agric. Food Chem. 2016. DOI: 10.1021/acs.jafc.6b01683)*

With the help of photoionization mass spectrometry, the authors measured the volatile compounds that were emitted over time during a roast. Using an algorithm, they were able to create chemical "fingerprints" that were characteristic of different roasting phases, and they discovered that four phases occurred: (1) "Evaporation," in which water is being removed from the beans; (2) "early roast"; (3) "late roast"; and (4) "over-roast."

Interestingly, the team also found that roasting phase fingerprints differed if the beans were slow-, medium- or fast-roasted. While the chemists' findings are certainly insightful, they may be of limited utility to the average coffee roaster. Mass spectrometers are not cheap, and it is highly

unlikely that a small roaster would invest in one. On the other hand, large companies may benefit from their research. (Notably, one of the paper's authors works for J.M. Smucker, which owns the coffee behemoth Folgers [3].) For those roasters, no price is too high for the perfect cup.

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Source [2]: Hendryk Czech, Claudia Schepler, Sophie Klingbeil, Sven Ehlert, Jessalin Howell, and Ralf Zimmermann. "Resolving Coffee Roasting-Degree Phases Based on the Analysis of Volatile Compounds in the Roasting Off-Gas by Photoionization Time-of-Flight Mass Spectrometry (PI-TOFMS) and Statistical Data Analysis: Toward a PI-TOFMS Roasting Model." *J. Agric. Food Chem.* Published: 16-June-2016. DOI: 10.1021/acs.jafc.6b01683

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