Uncovering the Volatile Profile of Potato Taste Defect in Roasted East African Arabica Coffee using GC-MS, GC×GC-TOFMS, and Chemometrics

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As coffee consumption increases globally, demands for specialty and/or high-quality coffee beans are primarily driven by consumer preferences toward the taste and aroma of the final brew. However, the presence of chemical defects can negatively impact the sensory properties of the coffee beans, which ultimately affects consumer experience and commercial trade. Potato taste defect (PTD), a unique to flavor defect to East African coffee, is characterized by a distinct musty, vegetable, raw potato aroma due to the presence of 2-isopropyl-3-methoxypyrazine (IPMP). To first correlate the severity of odor attributed to PTD, specialty ground roasted coffee samples from East Africa were subjected to olfactory analysis and headspace solid-phase microextraction gas-chromatography-mass spectrometry (HS-SPME-GC-MS). The concentration of IPMP was found to discriminate between samples classified as clean (i.e., no off-odor) and those identified as having mild, medium, or strong PTD odor. Next, HS-SPME comprehensive two-dimensional GC coupled to time-of-flight MS (HS-SPME-GC×GC-TOFMS) was employed to uncover additional compositional differences between non-defective and defective samples due to its enhanced peak capacity. Examination of the GC×GC-TOFMS data with tile-based Fisher ratio (F-ratio) analysis discovered hundreds of additional analytes that discriminate clean coffee samples from those affected by PTD. Analytes that were positively correlated with odor severity generally had unpleasant sensory descriptions, while analytes typically associated with desirable aromas were found to be negatively correlated with odor severity. These findings not only show that IPMP concentration can differentiate the severity of PTD, but also that changes in the volatile analyte profile of coffee beans induced by PTD can contribute to odor severity.