
Altering aromas by applying cold plasma processing

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Aroma is an important sensory property of foods and, alongside flavor and texture (mouthfeel), contributes to the overall sensory experience when eating. While our taste buds can only perceive five stimuli (salt, sweet, sour, bitter, and umami), we can perceive many more odors. As such, most of the eating experience comes from our sense of smell rather than taste. Food processing can alter the odor of several products, and the industry usually relies on adding artificial aromas and essential oils to improve aromas. Our studies have investigated how green chemistry through the application of cold plasma can help improve the aroma and mitigate off-flavors of several food products. Studies were carried out with orange juice, camu-camu juice, pineapple juice, coffee, lemon essential oil, and citral essential oil, comprising many volatile compounds and chemical classes of compounds. Changes in terpenes, sesquiterpenes, alcohols, aldehydes, esters, pyrazines, furans, and pyrroles were measured. Chemical pathways were proposed and correlated to the changes in aroma and mitigation of off-flavor compounds.

The type of cold plasma technology (glow discharge and dielectric barrier discharge) and the applied operating conditions (voltage, excitation frequency, gas flowrate, and time) significantly influence the kind of reaction imparted to the food aroma. Glow discharge induced more hydrolysis and etching reactions. In contrast, dielectric barrier discharge caused more hydrogenation, isomerization, and hydrolysis at low excitation frequencies and more oxidation and etching at high excitation frequencies.

Green chemistry thought the application of cold plasma could be used to modulate, improve or correct the aroma of several products. Cold plasma showed good modulation capacity of cooling aroma descriptors, such as fenchol, borneol, and camphene, in products containing high terpenoids. Herbal and green descriptors, characterized by several terpenes, alcohols, and aldehydes, also showed high modulation capacity allowing the increase or decrease in the perception of these descriptors in several juices. Nutty and roasted descriptors could be improved in coffee by the changes induced in furans and pyrazines. Thus, cold plasma could be used as a process to change aromas in food products.