Title Efficiency of coating process and real-time volatile release in tomatillo and tomato

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Abstract

Fifteen food powders were coated on aluminum targets at 0, + 25, and -25 kV using corona electrostatic coating at 20% to 80% relative humidity (RH). The effect of RH on 3 losses, that is, targeting loss, coating loss, and transportation loss, which contribute to coating efficiency, was studied. RH had no effect on targeting loss in either nonelectrostatic or electrostatic coating. In nonelectrostatic coating, increasing RH increased coating loss for powders with particle size ≥297 μm, but had no effect on powders ≤ 227 μm. Large powders were free-flowing and clumped with increasing RH, and then rolled off the targets, resulting in high coating loss. RH had no effect on nonelectrostatic transportation loss for all powders, except for very high absolute humidity when capillary forces dominated. Electrostatic charging efficiency and powder resistivity decreased with increasing RH. Electrostatic coating loss for salts increased with increasing RH. At high RH, powder resistivity decreases, increasing the charge decay rate, which decreases electrostatic adhesion. Electrostatic coating loss for powders other than salts, whose resistivities are much higher than salts, was not affected by RH until 80% RH. Electrostatic transportation loss for powders other than proteins was not affected by RH. There was no significant difference between positive and negative electrostatic transfer efficiency and adhesion, except for transfer efficiency of soy protein and pork gelatin, whose high positive tribocharging values cause higher positive electrostatic transfer efficiency. A 20% to 60% RH is recommended for both nonelectrostatic and electrostatic coating.

Lipid-related volatiles were measured in real time after the blending of grape tomatoes, using selected ion flow tube mass spectrometry (SIFT-MS). Measurements were made at 4, 23, or 37°C. The volatiles in the headspace of the tomatoes, other than hexanal, increased with increasing temperature. The concentration of hexanal in the headspace increased from 4 to 23°C, but decreased at 37°C. The activity of hexanal-specific hydroperoxide lyase decreases at 37°C. Moreover, precursors of hexanal may go through alternative pathways to form *trans* -2-heptenal and *trans* -2-octenal. The increase in concentration in the headspace for most volatiles can be explained by the increase in volatility, except for *trans* -2-heptenal, *trans* -2-octenal, and *trans* -2-pentenal. These three volatiles appear to be generated at a much higher rate

at 37°C due to the dominance of alternate pathways at this temperature. Temperature did not affect the time to peak level for most volatiles, except the time for hexanal was shorter with increasing temperature. A temperature-dependent lipoxygenase pathway was postulated.

The release of volatiles from tomatillo and tomatoes in the mouthspace and nosespace was measured in real-time using selected ion flow tube mass spectrometry (SIFT-MS). *cis* -3-Hexenal, *trans* -2-hexenal, hexanal, and 1-penten-3-one increased, while isobutyl alcohol, nonanal and methylbutanal showed no significant change in the first 30 s of chewing. Cherry tomato released more *trans* -2-hexenal, *cis* -3-hexenal, and 1-penten-3-one than tomatillo, roma tomato and vine-ripened tomato during chewing. The ratio of the average concentration of volatiles in the mouthspace after swallowing to before swallowing (MSas/MSbs) varied from 2.8 to 73.9%. Methylbutanal, hexanal, and nonanal were retained at a higher percentage in the mouth after swallowing than *cis* -3-hexenal, *trans* -2-hexenal, 1-penten-3-one and isobutyl alcohol. The mouthspace to headspace (MS/HS) ratio of 1-penten-3-one, hexanal, methylbutanal, and nonanal, and nosespace to headspace (NS/HS) ratio for 1-penten-3-one, hexanal, *cis* -3-hexenal, and nonanal was significant higher in tomatillo than in tomatoes. There was no difference between tomatoes of different varieties in NS/HS ratio.

The concentration of 31 volatiles were measured in the headspace of tomatillo using selected ion flow tube-mass spectrometry (SIFT-MS), and were compared with those in vine-ripened tomato, roma tomato, cherry tomato and grape tomato. None of volatiles was higher in the headspace of tomatilloes than of tomatoes. *trans* -2-Octenal and *trans* -2-pentenal, 2-isobutylthiazole, 6-Methyl-5-hepten-2-one and phenylacetaldehyde were significantly lower in tomatillo than in the tomato varieties in the headspace. After blending, volatiles in the headspace increased, and then decreased after reaching a maximum concentration, due to further degradation or depletion. *trans* -2-Pentenal and 1-Penten-3-one reached a maximum concentration later than *trans* -2-hexenal, *cis* -3-hexenal and hexanal for tomatillo and tomatoes. The slope of the ratio of *trans* -2-hexenal and *cis* -3-hexenal was not significantly different for any of the samples, implying that the activity of cis/trans isomerase was not different between tomatilloes and tomatoes.