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Do transition metals and phenolic compounds affect apple-juice yields?

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Vidot K *et al.*

Metallic ions distribution in texture and phenolic content contrasted cider apples.

Postharvest Biology and Technology . 2020 - https://doi.org/10.1016/j.postharvbio.2019.111046

Vidot K *et al.*

Phenolic distribution in apple epidermal and outer cortex tissue by multispectral deep-UV autofluorescence cryo-imaging.

Plant Science . 2019 - https://doi.org/10.1016/j.plantsci.2019.02.003

Partnerships

This work was carried out in partnership with INRAe–Angers USC 1422 GRAPPE, INRAE–Angers School of Agricultural Engineering–SFR QUASAV, the SOLEIL Synchrotron facility in Gif-Sur-Yvette, GEPEA–Environmental Engineering UMR 6144 CNRS–University of Nantes in Saint-Nazaire, and led as part of PhD thesis work by Kevin Vidot.

Contact

Marc Lahaye

UR BIA

marc.lahaye@inrae.fr

Context

The IONS project brief was to investigate the effect of variability in metal ion and phenolic content on oxidative degradation processes in the plant cell wall. The literature reports that oxidative degradation occurs when fruit ripens, prompting us to posit that oxidative degradation processes may affect the release and filtration of juice from the must. With that vision, we studied the content and distribution of transition metals and phenolic compounds in two cider-apple varieties of contrasting firmness over two years of harvest. We used model solutions to assess the impact of these variations on the degradation of pectin, a key cell-wall polysaccharide that shapes the texture of fruit.

Results

The in-sample ions and phenolic compounds were mapped at the SOLEIL synchrotron facility using fluorescence cryo-microscopy. Special-purpose low-temperature sample preparation and observation methods were developed to keep diffusion of these compounds contained. We exploited the deep-UV-region wavelengths to chart the distribution of different families of phenolic compounds typically found in apple. In parallel, we also localized the metal ions, which showed substantial variations in distribution within apple tissues and within varieties but even more significant variations between years of harvest. Pressing the fruit brings the phenolics and ions into contact. A study carried out with model solutions showed that a major phenolic compound in apples could drive or dampen the oxidative degradation of pectins depending on iron content.

Future outlook

In addition to the methods developed for localizing diffusible solutes that are transposable to other highly hydrated matrices, these results raise prospects for monitoring metal ions as oxidation-process markers involved in the development of palatability and processability properties in fruit musts and fruit juices.