How does food processing influence the functional properties of secondary metabolites in fruit-derived foodstuffs? The example of polyphenol oxidation in apple juices and ciders

Sylvain Guyot

How does food processing influence the functional properties of secondary metabolites in fruit-derived foodstuffs? The example of polyphenol oxidation in apple juices and ciders

Sylvain Guyot

INRA (National Institute for Agricultural Research), PRP, UR1268 BIA, 35653 Le Rheu, France.

sylvain.guyot@inra.fr

For a very long time, edible fruits and vegetables have been processed in order to elaborate fruit-derived products that are more convenient for transportation, storage and for a use all along the year even when the fruit season is over. Processes may correspond to very basic operations such as a simple cold storage in controlled atmosphere or may be much more sophisticated as it is the case for wine, beer or cider making. In the latter case and in particular for French cider making, the raw material corresponds to rustic cider apple varieties the particularity of which being their high content in phenolic compounds[1]. Those secondary metabolites are essential for the sensory properties of the ciders such as color[2], bitterness[3], astringency[3] and colloidal stability. In addition, it is now well admitted that polyphenols are also essential contributors to the health benefit related to fruit and vegetable consumption. Information related to organoleptic and nutritional properties of native polyphenols is well documented. In contrast, only few is still known concerning those neoformed phenolic molecules that are formed during fruit processing in particular as a result of enzymatic oxidation[4]. In the present lecture, taking example of our work on polyphenols in apple juice and cider making, we will show how native phenolic molecules can be converted into original new structures[5] that acquire specific and sometimes surprising properties[6]. In the future, this will open the door to the production of innovative apple-derived products that would contain larger amount of bioactive and nutritional compounds while still displaying very good sensory qualities.

References:

1. Sanoner, P., Guyot, S., Marnet, N., Molle, D., & Drilleau, J. F. (1999). Polyphenol profiles of French cider apple varieties (Malus domestica sp.). Journal of Agricultural and Food Chemistry, 47(12), 4847-4853.

2. Le Deun, E., Van der Werf, R., Le Bail, G., Le Quéré, J.-M., & Guyot, S. (2015). HPLC-DAD-MS Profiling of Polyphenols Responsible for the Yellow-Orange Color in Apple Juices of Different French Cider Apple Varieties. Journal of Agricultural and Food Chemistry, 63, 7675-7684.

3. Lea, A.G.H. Bitterness and astringency: the procyanidins of fermented apple ciders. In Bitterness in food and beverages; R.L. Roussef Ed.; Elsevier: Oxford, New York, 1990b, chap7, pp 123-143.

4. Guyot, S., Bernillon, S., Poupard, P., & Renard, C. (2008). Multiplicity of Phenolic Oxidation Products in Apple Juices and Ciders, from Synthetic Medium to Commercial Products. In F. Daayf & V. Lattanzio (Eds.), Recent Advances in Polyphenol Research, Vol 1, vol. 1 (pp. 278-292). Oxford: Wiley-Blackwell

5. Poupard, P., Sanoner, P., Baron, A., Renard, C., & Guyot, S. (2011). Characterization of procyanidin B2 oxidation products in an apple juice model solution and confirmation of their presence in apple juice by high-performance liquid chromatography coupled to electrospray ion trap mass spectrometry. Journal of Mass Spectrometry, 46(11), 1186-1197.

6. Zanchi, D., Konarev, P. V., Tribet, C., Baron, A., Svergun, D. I., & Guyot, S. (2009). Rigidity, conformation, and solvation of native and oxidized tannin macromolecules in water-ethanol solution. Journal of Chemical Physics, 130(24).

Aknowledgement : Some examples presented here were included in the regional projects MAIPROCI and CICHROM and we are grateful to Region Bretagne and Région Pays de la Loire for financial support and we thank also P2M2 analytical plateform (Réseau Corsaire, Biogenouest) for its involvment in polyphenol analysis.