



**HAL**  
open science

## Recent advances on the phenolic molecules and oxidative mechanisms involved in the color of classical and “rosé” cider apple juices

Erell Le Deun, H el ene F evrier, Jean-Michel Le Qu er e, Remi Bauduin, Sylvain Guyot

### ► To cite this version:

Erell Le Deun, H el ene F evrier, Jean-Michel Le Qu er e, Remi Bauduin, Sylvain Guyot. Recent advances on the phenolic molecules and oxidative mechanisms involved in the color of classical and “ros e” cider apple juices. 2. Euro-Mediterranean Symposium on Fruit and Vegetable Processing, Institut National de Recherche Agronomique (INRA). UMR UMR INRA / Univ. Avignon et Pays de Vaucluse : S ecurit e et Qualit e des Produits d’Origine V eg etale (0408)., Apr 2016, Avignon, France. hal-02738764

**HAL Id: hal-02738764**

**<https://hal.inrae.fr/hal-02738764v1>**

Submitted on 2 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire **HAL**, est destin ee au d ep ot et  a la diffusion de documents scientifiques de niveau recherche, publi es ou non,  emanant des  tablissements d’enseignement et de recherche fran ais ou  trangers, des laboratoires publics ou priv es.

## Recent advances on the phenolic molecules and oxidative mechanisms involved in the color of classical and “rosé” cider apple juices

E. Le Deun<sup>a</sup>, H. Février<sup>a</sup>, J.M. Le Quéré<sup>a</sup>, R. Bauduin<sup>b</sup> and S. Guyot<sup>a</sup>

<sup>a</sup>INRA, UR1268 BIA, PRP Team, BP35327, F-35653 Le Rheu, France

<sup>b</sup>Institut Français des Productions Cidricoles (IFPC), F-35653 Le Rheu, France

\* sylvain.guyot@rennes.inra.fr

The color of beverages accounts for a crucial criterion which influences the choice of the consumers [1]. Moreover, color differences are the source of innovative products as it is now attested by the development of pink ciders in the French market. In juices and ciders commonly produced, the color is mainly formed during the first steps of apple processing when fruits are crushed and pressed leading to the enzymatic oxidation of the polyphenols in the presence of polyphenoloxidase (PPO) and dioxygen. Still today, the structures of the molecules, the environmental factors and the mechanisms associated to color formation in juices and ciders are unclear. In addition, those mechanisms are rendered more complex in rosé products with the involvement of apple anthocyanins.

Our recent works aim to better know the molecules and the mechanisms that control the color in both conventional and rosé apple musts during the first steps of fruit processing. The varietal effect was studied using both classical French cider apple varieties and also red fleshed cultivars. Juices were prepared according to two contrasted modalities regarding the oxidation level. The color of the clarified juices was measured (CIE Lab) and the detailed polyphenol profiles were monitored by C18 HPLC coupled to UV-visible spectroscopy and mass spectrometry. PPO activities in the crude juices were measured by polarography.

For conventional juices, UV 420 nm chromatographic profiles allowed to distinguish between well-resolved peaks corresponding to yellow-orange phenolic oxidation products and a large unresolved absorbance hump. The latter was characterized as a complex colored fraction having tanning properties with regard to its large removal after gelatine fining [2]. In parallel, the structures of new colored oxidation products deriving from dihydrochalcones or corresponding to coupling products between flavanols and dihydrochalcones were clearly identified and confirmed in model solution using purified substrates and apple PPO.

For the musts issued from red fleshed apples, the crucial role of the cultivar was highlighted influencing both the polyphenol profiles and the PPO activity. Cyanidin-3-O-galactoside (*i.e.* ideain) was confirmed as the main anthocyanin contributing to the red color of the juice although it was more or less degraded depending on the cultivars. The underlying mechanisms were studied by HPLC monitoring of model solutions containing ideain, apple PPO and mixtures of standard compounds representative of the main other polyphenolic classes (*i.e.* chlorogenic acid, (-)-epicatechin, and procyanidin trimers). Results confirmed that ideain is not a substrate for PPO but can be extensively degraded by redox reactions involving other polyphenols. LC-MS analyses of the oxidised model solutions gave access to preliminary information concerning the structures and the formation mechanisms of those anthocyanins oxidation products.

### References:

1. Fergus M. Clydesdale (1993) *Crit. Rev. Food Sci. Nutr.*, **33**(1), 83-101.
2. Le Deun, E.; Van der Werf, R.; Le Bail, G.; Le Quéré, J.-M.; Guyot, S., (2015) *J. Agric. Food Chem.* **63**, 7675–7684.

**Acknowledgements:** CBB Capbiotek, Pole Agronomique Ouest, Régions Bretagne et Pays de Loire. Bernard Petit from INRA IRHS (Angers, France) for apple providing.