Degradation kinetics of anthocyanins in fruits and vegetables during heat treatment at high temperatures

REMINI H.[1], DAHMOUNE F.[1], MERTZ C.[2], ACHIR N.[2], BRAT P.[2], DORNIER M.[2], MADANI K.[1]

[1] Laboratoire de Biochimie, Biophysique, Biomathématiques et Scientométrie (L3BS), université A. Mira, Bejaia 06000, Algérie.
Tel : +213 7 72 18 62 24
E-mail : madani28dz2002@yahoo.fr

[2] UMR 95 QUALISUD, Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), 73 rue J. F. Breton, TA B-95/16, F-34398, Montpellier cedex 5, France.

Keywords: Anthocyanins, fruits and vegetables, high temperature degradation kinetics, modeling and optimization.

Summary

This work will focus on the physico-chemical (pH, moisture, Brix and titratable acidity) and the impact of different heat treatments (time-temperature torque) on the levels of phenolics (total polyphenols, flavonoids) and especially anthocyanins of blood orange varieties (Citrus sinensis).

Introduction

Anthocyanins are polyphenolic natural pigments, belonging to the flavonoid family, which have attracted increasing interest because of their wide range of colors (blue, purple, orange and red) of many fruits and vegetables. Anthocyanins are interesting for two reasons. The first is technology, namely their impact on the organoleptic characteristics of food, which can influence their technological behavior during food processing and the second because of their implicationdirecte in preserving human health, their anti Duea -oxidant. But despite the great potential of application of anthocyanins, their use has been limited due to their relative instability (especially at high temperature) and low percentage of extraction. Currently, most research on anthocyanins are focused on solving these problems, and their purification and identification. However, understanding the mechanisms of instability and degradation is often hampered by the variability of the raw material and the complex interactions and with many components of the food matrix.

Scientific needs

This present research will attempt to meet the needs of various industrial food during juice processing with high anthocyanin content to keep the color fresh juice. From this concept, the proposed approach is monitoring the degradation of anthocyanins at high temperature, divided into two parts:

1) A cognitive component: improving the understanding of the degradation of anthocyanins in high temperature and different processing methods. For this purpose, methods and tools will be developed for understanding the degradation of anthocyanins. Different learning systems should allow to disentangle the effects of each factor.

2) An application component: mobilization of previously acquired knowledge on real products and processes:

o Help in choosing the best varieties of plants according to their composition;

o Study of degradation in different thermal processes

o Use digital tools for the optimization of operating conditions or sequence of unit operations;

o Help with selecting the appropriate industrial process transformation juices high in anthocyanins.

Objectives

As we have seen, the objective of this research is twofold:

- Improved understanding of the degradation of anthocyanins in high temperature and different processing methods of different varieties of fruits and vegetables of interest (the study of the kinetics of degradation of each product);

- Mobilisation of the previously acquired knowledge to limit the effect of technological processes (in particular thermal processes) on the nutritional quality of these foods in terms of anthocyanins.

References

Acosta-Montoya, Ó., Vaillant, F., Cozzano, S., Mertz, C., Pérez, A. M., & Castro, M. V. (2010). Phenolic content and antioxidant capacity of tropical highland blackberry (Rubus adenotrichus Schltdl.) during three edible maturity stages. *Food Chemistry, 119*(4), 1497-1501.

Jiménez, N., Bohuon, P., Lima, J., Dornier, M., Vaillant, F., & Pérez, A. M. (2010). Kinetics of Anthocyanin Degradation and Browning in Reconstituted Blackberry Juice Treated at High Temperatures (100–180 °C). *Journal of Agricultural and Food Chemistry, 58*(4), 2314-2322.

Mertz, C., Cheynier, V., Günata, Z., & Brat, P. (2007). Analysis of Phenolic Compounds in Two Blackberry Species (*Rubus glaucus* and *Rubus adenotrichus*) by High-Performance Liquid Chromatography with Diode Array Detection and Electrospray Ion Trap Mass Spectrometry. *Journal of Agricultural Food Chemistry, 55*, 8616–8624.

Mertz, C., Gancel, A. L., Gunata, Z., Alter, P., Dhuique-Mayer, C., Vaillant, F., Perez, A. M., Ruales, J., & Brat, P. (2009). Phenolic compounds, carotenoids and antioxidant activity of three tropical fruits. *Journal of Food Composition and Analysis, 22*(5), 381-387.