

Polyphenol oxidase from Croatian traditional apple varieties and its role in anthocyanins degradation during storage

Ana-Marija Gotal Skoko¹, Tihomir Kovač¹, Goran Fruk², Antun Jozinović¹, Drago Šubarić¹, Krunoslav Aladić¹, Jurislav Babić¹, Ante Lončarić^{1*}

¹University of Josipa Jurja Strossmayera in Osijek, Faculty of Food Technology Osijek, Franje Kuhača 18, 31000 Osijek, Croatia

²University of Zagreb, Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia

INTRODUCTION

Anthocyanins, even those presenting a catechol group such as cyanidin glycosides, are not substrates for PPO. However, anthocyanins with o-diphenol B ring (cyanidin-3-galactoside) can be oxidised through coupled oxidation-reduction reactions with enzymatically generated o-quinone such as chlorogenoquinone (i.e. o-quinone of caffeoylquinic acid). Moreover, non o-diphenolic anthocyanins can form adducts with o-quinone by non-enzymatic condensation reactions. These reaction pathways involving anthocyanins, colourless polyphenols and PPO are likely responsible for colour changes during the early stages of red-fleshed apple processing. The objective of this work was to establish the role of PPO on total anthocyanins present in Croatian traditional apple varieties.

MATERIALS AND METHODS

In this work, we investigate the activity of PPO and its role in anthocyanins degradation during the storage of Croatian traditional apple varieties. Polyphenol oxidase was extracted from five Croatian traditional apple varieties ('Austrougarka', 'Božićnica', 'Čelenka', 'Ílzer Rosenapfel' and 'Kraljevčica') after harvest and after three months of storage. Furthermore, the activity of polyphenol oxidase (POA) was determined with the substrate catechol by a continuous spectrophotometric test at 410 nm. The monomeric anthocyanin pigment content of extracts was determined using the pH-differential method.

RESULTS

After harvest, the highest activity of polyphenol oxidase was determined in 'Božićnica' (302%) and the lowest in 'Čelenka' (172%). During storage, the activity of polyphenol oxidase was decreased in four apple varieties while in 'Ílzer Rosenapfel' the activity of polyphenol oxidase was increased. After three months of storage, the highest activity of polyphenol oxidase had 'Ílzer Rosenapfel' (349%) and the lowest had 'Čelenka' (171%). Considering anthocyanins, the highest content of anthocyanins after the harvest had 'Čelenka' (48.09 mg/L) and the lowest had 'Kraljevčica' (3.0 mg/L). The highest content of anthocyanins after three months of storage had 'Čelenka' (47.59 g/L) and the variety without anthocyanins after storage was 'Ílzer Rosenapfel'.



CONCLUSION

The increase of polyphenol oxidase activity during storage caused degradation of anthocyanins in 'Ílzer Rosenapfel' apple variety which leads to discolouration. This is due to the ability of polyphenol oxidase and polyphenol peroxidase to break covalent bonds between anthocyanin glycosides. In conclusion, varieties with the highest activity of polyphenol oxidase had the lowest content of anthocyanins and vice versa.

Acknowledgements:

This work was supported by the project UIP-2020-02-8461 (The Croatian Science Foundation).