Grape Research from Processed Foods Research Unit, WRRC, Albany, CA

Characterization of Anthocyanins in the Skin and Flesh of New Red Grape Cultivars

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Our goal was to identify and quantify anthocyanins in the skin and flesh of new red grape cultivars developed by David Ramming

ANTHOCYANINS

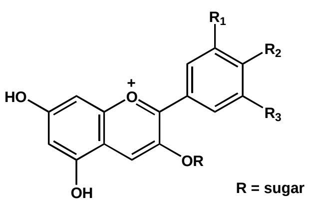
•The largest group of water-soluble pigments in plants;

•Responsible for most of the red, blue, and purple colors of fruits, vegetables, flowers, and other plant tissues;

•Are all based chemically on a single aromatic structure, cyanidin, and all are derived from this compound by the addition or subtraction of hydroxyl groups, and by the nature and number of sugars and their position on the aglycon;

•Sugars can be esterified with aliphatic or aromatic acids leading to mono- and polyacylated anthocyanins

Structure of Six Common Anthocyanins



Aglycon	R_1	R_2	R_3
Cyanidin	OH	OH	H
Pelargonidin	H	OH	H
Delphinidin	OH	OH	OH
Peonidin	OCH_3	OH	H
Petunidin	OH	OH	OCH_3
Malvidin	OCH_3	OH	OCH_3

Why Study Anthocyanins?

•They are antioxidants that have potential health benefits in reducing the risk of chronic and degradative diseases such as cancer, cardiovascular diseases and Alzheimer's disease

•They have potential as natural colorants to replace synthetic colorants

•It is important to know anthocyanin composition since anthocyanins have different chemical (i.e., stability) and physiological (i.e., absorption/metabolism) properties

MATERIALS AND METHODS

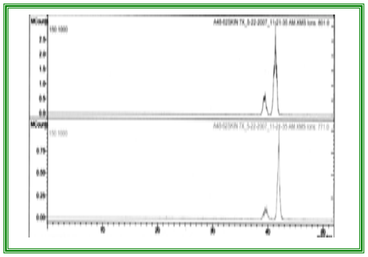
Anthocyanins in Grape Skin and Flesh:

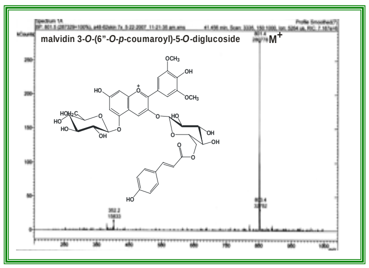
Samples were prepared as follows:
1 g (skin or flesh) was extracted with 4 mL of 0.5% TFA in MeOH by sonication for 15 min. The sample was shaken twice during sonication procedure. The extraction was repeated with the same volume of solvent. The extract was filtered and the solvent was evaporated. The extract was dissolved in water (1 mL). The extract was loaded on a C18 cartridge (previously activated with 3 mL of MeOH followed by 3 mL of water). The cartridge was washed with 6 mL of 0.05% HCl in water. The anthocyanins were eluted with MeOH.

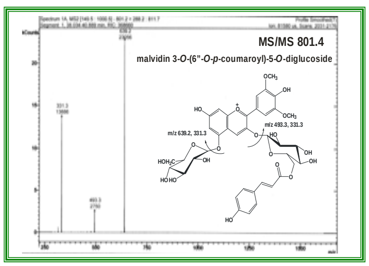
Anthocyanin characterization:
Anthocyanins were separated and identified using reversed phase high performance liquid chromatography (HPLC) and electrospray ionization (ESI) quadrupole ion trap mass spectrometry.

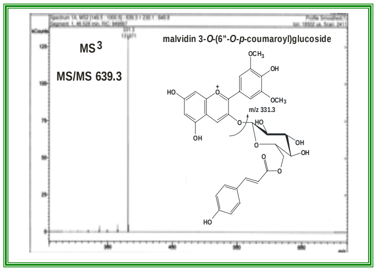
RESULTS

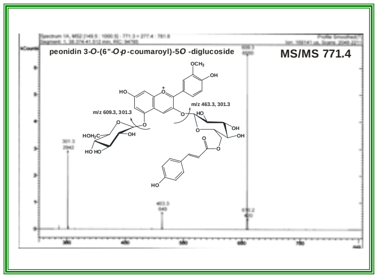
The following figures show some examples of the use of LC/MS^n to identify anthocyanins in grape samples.

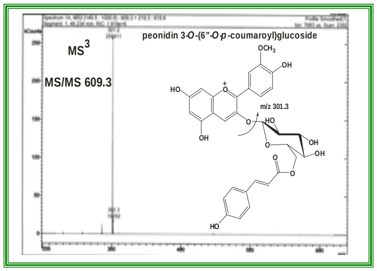












CONCLUSION

• We have investigated anthocyanins in the skin and flesh of seven grape cultivars using LC/MS.

• The MS and MS^n spectra obtained with the ion trap mass spectrometer were crucial in identifying anthocyanins present in grape samples.

• MS data was effective in distinguishing co-eluting constituents which can occur with samples with complex anthocyanin profiles such as red grapes.

• In general, grape skins contained higher concentrations of acylated anthocyanins which have greater color stability than non-acylated anthocyanins.

Microwave-Assisted Drying of Grapes

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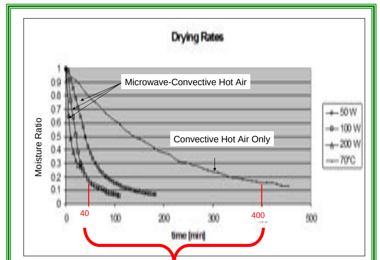
Drying grapes into raisin using solely convective hot air takes long drying times and results in brownish-reddish raisins if no pre-treatments are applied. Our objectives were to a) determine drying rates and temperature profiles of microwave-assisted drying, and b) to measure color quality of resulting raisins.



10x's more of heating time using convective hot air alone

Microwave power requirement is very low to penetrate and heat internal regions of grapes. In this case, the optimum power requirement was only 100 W, which is 1/10 the power from a typical domestic microwave oven.

CONCLUSION

Drying Comparison: Convective Hot Air vs. Microwave-Convective Hot Air

Convective Hot Air Drying:

- To increase the drying rate, increased surface temperatures are needed to increase heat conduction towards the center regions.

Microwave-Assisted Convective Hot Air Drying:

- Microwave energy can penetrate and heat foods quite well.
- Can heat foods high in sugar content without scorching or carmelizing the sugars in the product.
- Since microwave energy is used to heat the center regions, the surface of foods do not have to be overheated to conduct heat internally.
- Thus, an optimum scheme of drying incorporates low microwave power and lower convective hot air temperature resulting in overall less drying time and overall less energy expenditure.