Methods to Increase Thermal Stability of Anthocyanins as Natural Food Colorants

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Introduction

What are Anthocyanins?
- Glycosylated anthocyanidans
- Aglycones contain hydroxyl or methoxy substitutions
- Creates differences between main anthocyanidins
- Glycosidic substitution occurs at positions 3 or 5
- Typical sugars include glucose, galactose, xylose, rhamnose
- Main differences between anthocyanidins found in nature

Anthocyanin Applications in Food
- Produced from vegetables or processing wastes
- Used in low pH products as a red color
- Some high pH applications as a blue color
- Fruit Fings
- Confectionary
- Sauces
- Salad Dressings

Why use Anthocyanins in Foods?
- Provide red to purple to blue colors
- Natural sources: fruits, vegetables, flowers
- Clean label
- a* of C3G+WPI

Anthocyanins

Stabilization Methods

Copigmentation (Cortez and others 2017)
- Non-covalent associations: hydrophobic interactions, hydrogen bonding, ionic interactions
- Conjugated structure allows complexes to form
- Anthocyanin complexed with biomacromolecules such as guar gum, Gum Arabic, and others

Encapsulation (Tahmooressi and others 2010)
- Creates a barrier that reduces reactivity and helps maintain functional characteristics
- Achieved by spray drying or freeze drying
- Agents may be carbohydrates, lipids or proteins. Maltodextrin and Gum Arabic have been successful

Metallic Ion Addition (Tahmooressi and others 2014)
- Hydroxyl groups associate with metal ions
- Showed to stabilize anthocyanins with more than one free hydroxyl group via chelation
- Cyanidin, delphinidin, petunidin
- Algininate and Iron has shown to be effective

Anthocyanins

Industry Outlook

Consumer demand for natural colors has long been on the rise

Natural color market projected to hit $2.5 billion by 2025

3 in 5 consumers avoid synthetic colors
7% compound annual growth rate 2016-2025 expected for anthocyanins, specifically

Challenges

Anthocyanins lose hydrogen ions as the pH increases, and they become progressively more unstable. The color shifts from red to purple to blue (Woolfolk & Culver 2012)

Anthocyanin Applications in Food

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Discussion

What we know now (and what we don’t):
- Degradation and color fading during thermal processing are a known problem regarding anthocyanins
- Due to differences in structure, different anthocyanins inherently have different stability at different conditions of followings:
  - The thermal degradation pathway is largely unknown

Current Limitations:
- Many studies have only investigated at lower processing temperatures
- Many studies are limited to model systems
- Some materials may have unintended side effects such as turbidity

References


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Conclusion

By better understanding the true degradation pathway, we can better develop appropriate stabilization anthocyanins. Scientists must continue experimenting with different material combinations. Copigmentation seems to be one of the most promising methods for the future. Stabilizing anthocyanins in response to heat would greatly expand applications of foods, create new products for consumers that are conscious of clean label ingredients, and possibly provide antioxidant benefits to the public.

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