

Synergistic Stabilization of Strawberry (*Fragaria* $\times$ *ananassa*) Anthocyanins using Organic Vegan Protein Hydrolysates against Ascorbic Acid-Induced Bleaching

Marie-Soleil Seshat Landry
MarieLandrySpyShop.com

December 25, 2025

Abstract

Strawberry anthocyanins are highly sensitive to oxidative bleaching, particularly in the presence of endogenous or added ascorbic acid. This study proposes a novel, organics-first stabilization method using vegan-sourced protein hydrolysates (Organic Pea Protein) to form "proteo-shield" complexes. We hypothesize that these complexes will significantly reduce the degradation rate of pelargonidin-3-glucoside compared to non-complexed controls. This paper outlines the pre-experimental design, methodology, and operational definitions.

1 Introduction

Anthocyanins are the primary phytochemicals responsible for the red hue and antioxidant capacity of strawberries (?). However, their stability is compromised by the "Ascorbic Paradox," where Vitamin C accelerates pigment degradation (?). Current stabilization research often utilizes synthetic or animal-based carriers, which do not align with vegan or organic-certified standards. This research explores the efficacy of organic pea protein hydrolysates as a plant-based co-pigmentation agent.

2 Methodology (SOP)

2.1 Materials & Reagents

- **Sample:** Fresh organic, non-GMO strawberries (*F. ananassa*).
- **Stabilizer:** Organic-certified, vegan pea protein hydrolysate.
- **Solvent:** Organic ethanol/distilled water (1% citric acid for pH control).

2.2 Experimental Design

We will utilize a randomized controlled trial with three groups: 1. **Control (C):** Pure strawberry extract. 2. **Oxidative Stress (OS):** Extract + 50mg/L organic ascorbic acid. 3. **Proteo-Shield (PS):** Extract + 50mg/L organic ascorbic acid + 1% pea protein hydrolysate.

2.3 Data Collection Plan

Absorbance will be measured via spectrophotometry at $\lambda_{max} = 520$ nm over a 7-day period at 25°C.

3 Hypothesis Formulation

Null Hypothesis (H_0): There is no significant difference in the degradation rate (μ) of anthocyanins between the PS group and the OS group ($H_0 : \mu_{PS} = \mu_{OS}$).

Alternative Hypothesis (H_a): The PS group will exhibit a significantly lower degradation rate than the OS group ($H_a : \mu_{PS} < \mu_{OS}$).

4 Results (Placeholders)

[INSERT RAW SPECTROPHOTOMETRIC DATA HERE] [INSERT FIGURE 1: ABS-TIME DEGRADATION CURVE]

5 Discussion (Placeholders)

[INTERPRETATION OF PROTEIN-ANTHOCYANIN BINDING AFFINITY] [LINK TO LITERATURE: COMPARISON WITH SYNTHETIC STABILIZERS]

6 References

- Hong, H. T., et al. (2025). Phytochemicals, Organic Acid, and Vitamins in Red Rhapsody Strawberry. *Foods*, 14(3), 379. DOI: 10.3390/foods14030379
- ACS Omega (2024). Enhancing the Stability of Strawberry Anthocyanins Complexed to β -Cyclodextrin. *ACS Omega*, 9(4). DOI: 10.1021/acsomega.3c06311
- NIH (2025). Factors affecting the stability of anthocyanins: A review. *PMC11497485*.