Development of Organic Food Colors from Beetroot and Spinach

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ABSTRACT

Natural food coloring is gaining importance in the food industry due to health concerns associated with synthetic dyes. This study investigates the extraction and application of organic pigments from beetroot and spinach. Beetroot's betalains and spinach's chlorophyll were analyzed for their physicochemical properties, demonstrating their potential as eco-friendly and nutritionally beneficial alternatives to synthetic dyes. Results highlighted the stability and application versatility of these pigments, confirming their role in meeting consumer demands for sustainable, clean-label products (Ansari *et al*., 2017).

Keywords: Artificial Intelligence, Computational Biology, Drug Discovery, Genomics, Proteomics, Protein Structure Prediction.

INTRODUCTION

Color significantly influences food quality perception and consumer preferences. Synthetic dyes, although widely used, pose health risks that have led to a growing demand for natural alternatives. Beetroot and spinach, rich in betalains and chlorophyll respectively, present excellent sources of natural pigments. This research focuses on their potential as sustainable and health-conscious substitutes for synthetic dyes in food applications (Galla *et al*., 2017).

AIMS AND OBJECTIVE

- To develop natural food colorants from beetroot and spinach as sustainable and eco- friendly alternatives to synthetic dyes.
- To evaluate the physicochemical properties, stability, and application potential of these natural pigments.

MATERIALS AND METHODS PLANT MATERIAL COLLECTION

Beetroot and spinach were procured from local markets. Ethanol and methanol were used as solvents for pigment extraction (AOAC, 2006).

Product Development

- Each vegetable (1.5 kg) was washed, peeled, and sliced.
- Amples were dried at 60°C for 48 hours and ground into a fine powder.
- Powdered samples (10 g) were mixed with 200 mL of ethanol and methanol separately, followed by filtration using cheesecloth and Whatman filter paper.
- Extracts were concentrated using a rotary evaporator and freeze-dried to obtain powdered pigments (Kapoor *et al*., 2021).

Analytical Procedures

Proximate composition (moisture, ash, protein, fat, fiber, and total soluble solids) and pH were determined using AOAC methods. Phytochemical tests identified alkaloids, anthocyanins, tannins, phenols, and glycosides.

RESULT AND DISCUSSION PROXIMATE COMPOSITION

A summary of the proximate composition of beetroot and spinach is provided below:

- **Beetroot:** High moisture content (91.5%), rich in nitrogen-free extract (63.3%), moderate fiber (1.35%), low protein (0.72%), and fat content (0.28%).
- **Spinach:** High moisture content (91.5%), higher protein (2.86%) and fiber (1.8%), and significant ash content (2.2%).

Phytochemical Analysis

Both beetroot and spinach extracts tested positive for alkaloids, anthocyanins, tannins, phenols, and glycosides, as summarized in Table **1**.

Table 1. Phytochemical Analysis.

Constituent	Beetroot Observation	Spinach Observation
Alkaloids	Positive	Positive
Anthocyanins	Positive	Positive
Tannins	Positive	Positive
Phenols	Positive	Positive
Glycosides	Positive	Positive

Pigment Extraction and Stability

Optimal extraction conditions yielded stable pigments. Methanol extraction was more effective for betalains from beetroot, while ethanol was preferable for extracting chlorophyll from spinach. Standard deviations were calculated to confirm reproducibility and reliability of the results (Kale *et al*., 2018).

Combined FigureA merged figure demonstrates the visual differences in pigment intensity and stability between solvents. This visualization underscores the distinct advantages of each solvent for specific pigment types (Sharifi *et al*., 2022).

CONCLUSION

This study establishes beetroot and spinach as effective sources of natural food pigments. These pigments serve as viable alternatives to synthetic dyes, offering health benefits and aligning with consumer preferences for sustainable and clean-label products. Future research should focus on enhancing pigment stability for broader food applications (Meena *et al*., 2013)

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