

# Extraction and Estimation of Betalain Content in Beetroot (*Beta vulgaris*)

Usha Devi C.<sup>1</sup>, Radhika D Prabhu.<sup>2</sup>, Keshamma E.<sup>3</sup>

<sup>1,2</sup>*Department of Food and Nutrition, Smt. V.H.D Central Institute of Home Science, Seshadri Road, Bengaluru, Karnataka, India*

<sup>3</sup>*Department of Biochemistry, Maharani's Science College for Women, Palace Road, Bengaluru, Karnataka, India*

**Abstract**—The present study was designed to undertake with the main purpose of extraction and estimation of betalain content in Beetroot (*Beta vulgaris*). Beetroot was purchased from a local market in Bangalore, Karnataka. 600 g of beetroot was washed and peeled. It was then grinded using a grinder and kept in the oven at 100°C for 30-40 min. The sample was then powdered using a blender and stored in an airtight container under refrigerated conditions (4°C) for further analysis. 0.05g of beetroot extract was diluted with 20.50 ml of deionized water and the absorbance of the diluted juice was read at 538 nm is using a spectrophotometer measured as mg betalains/100 g. The results revealed that, the betacyanin and betaxanthins content of beetroot (*Beta vulgaris*) was estimated as 364.93 mg/L and 249.40 mg/L respectively, and hence total betalains was 614.33 mg/L. In conclusion, our findings delineated the beetroot samples procured from local provinces are rich sources of betalains and hence beetroot extract could be recommended as antibacterial agent and viable food ingredients as antioxidant.

**Index Terms**—*Beta vulgaris*, Betalains, Extraction, Antibacterial, Antioxidant

## I. INTRODUCTION

Plant derivatives have been used for centuries for therapeutic and prophylactic purposes. At present, approximately 80% of the world's population is estimated to rely on botanical preparations as medicines to meet their health needs [1,2]. There are many natural plant products with antifungal, antibacterial and antiprotozoal activity that can be used systemically or locally. Currently, from one-quarter to one-half of all pharmaceutical products of higher plant origin in the world. Countries such as India meet the needs of medicinal sources primarily from plants to cure infectious diseases [2]. Among

the various plant products, pigments are one of the alluring features on the Earth.

Currently, in the food industry, cosmetics, pharmaceuticals, pigments of various types and forms have been used as additives or supplements [3]. The need for natural colorants has increased as consumers become more aware of the toxicity of synthetic colours. Natural colors are often referred to as biocolours, usually derived from vegetables, fruit, roots and microorganisms due to their biological source. Pigments act as bioactive agents against skin diseases and act as antioxidants, anti-inflammatory, anti-analgesic and chemo preventive agents against cancer [4].

Among pigments with natural origin, betalains represent a group of valuable products for the pharmaceutical, chemical, food and feed industries not only because they can act as antioxidant agents but also because of their possible tumor inhibiting activity through the removal of oxygen radicals. Betalains are water-soluble nitrogen-containing pigments, found in high concentrations in red beet (*Beta vulgaris*). Betalains consist of two subclasses: betacyanins (red violet pigments) and betaxanthins [5,6].

With this viewpoint, the present study was designed to undertake with the main purpose of extraction and estimation of betalain content in Beetroot (*Beta vulgaris*).

## II. METHODS

### A. Collection of Beet Root and Preparation

Beetroot (*Beta vulgaris*) was used as a source of the natural pigments viz. *betalains* in the present study. Beetroot was purchased from a local market in Bangalore, Karnataka. 600 g of beetroot was washed and peeled. It was then grated using a grater and kept in the oven at 100°C for 30-40 min. The sample was then powdered using a blender and stored in an airtight container under refrigerated conditions (4°C) for further analysis. 200 g of dried beetroot powder was mixed with 500 ml of water. It was mixed vigorously to get a homogenized solution. This was subjected to vacuum evaporation at 80°C for 3 hrs. The residue was collected and kept under refrigeration for further analysis.

### B. Extraction

As betalain is water soluble pigment, and hence it was extracted using water. 200 g of dried beetroot powder was mixed with 500 ml of water. It was mixed vigorously to get a homogenized solution. This was subjected to vacuum evaporation at 80°C for 3 hrs. The residue was collected and kept under refrigeration for further analysis as described by Francis [7].

### C. Estimation of betalains content

0.05g of beetroot extract was diluted with 20.50 ml of deionized water and the absorbance of the diluted juice was read at 538 nm using a spectrophotometer (Model: UV-Spectrophotometer, Spectronic® Genesys™ 2 Instruments, USA), measured as mg betalains/100 g using the following equation as determined by Castellar et al. [8].

$$\text{Total Betalains [mg/100g]} = A \times DF \times Mw \times 100 / \epsilon \times L$$

where in

A – Absorbance

DF – Dilution factor

MW – Molecular weight

$\epsilon$  – Molar extinction coefficient

## III. RESULTS AND DISCUSSION

The results revealed that, the betacyanin and betaxanthins content of beetroot (*Beta vulgaris*) was estimated as 364.93 mg/L and 249.40 mg/L respectively, and hence total betalains was 614.33 mg/L (Figure 1).

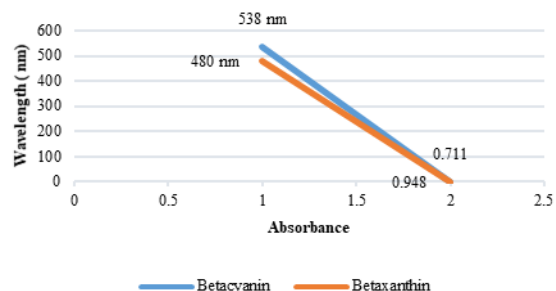


Figure 1: Spectrophotometric analysis of betalain pigment in beetroot extract

These findings were in accordance with the findings of Zakharova and Petrova (1997) wherein authors found that, the total betalain content of red beet was 250 to 850 mg/100g on fresh weight [9]. While Delgado et al., (2000) found that, red pigment content in red beet could reach 500 mg/100g on fresh weight [10]. Furthermore, Laura et al found that betalains in fresh spring red beet was 8.38 mg/g in comparison to fresh autumn red beet 4.62 mg/g [11].

Red beetroot is a rich source of betacyanin. These are nitrogen containing compounds widely used as non-toxic food colorants. The deep red color of beets is due to the presence of betalain pigments. There are two categories of betalains: the purple betacyanins and yellow betaxanthines pigments [12], functionally replace anthocyanins in 13 taxons grouped in Caryophyllales order. The major advantages of betalains as dietary antioxidants are their bioavailability, which is greater than most flavanoids, and their superior stability in comparison to anthocyanin. The potential beneficial effects of the high antioxidants capacity and protection of cells from free radical attack seem clear in beetroot extracts [13]. Furthermore, Vijaya and Thangaraj reported that the beetroot containing betalains is a promising source of a natural antibacterial agent and certainly provides an alternative to synthetic colorant due to its beneficial properties and opens up a new aspect of the beetroot research trend as a natural antibacterial agents and viable food ingredient [14]. These antioxidant and anti-bacterial properties of beetroot could be attributed to total flavonoid class betalains content of beetroot.

#### IV. CONCLUSION

In conclusion, our findings delineated the beetroot samples procured from local provinces are rich sources of betalains, and hence beetroot extract could be recommended as antibacterial agent and viable food ingredients as antioxidant.

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