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Spectral characterization of betanin

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Abstract:
The betanin from the roots of Red beet was extracted using solid-liquid extraction. This extract was characterized using FTIR spectroscopy and UV-Vis spectrophotometry.

Keywords: betanin, UV-Vis spectra, FTIR spectra

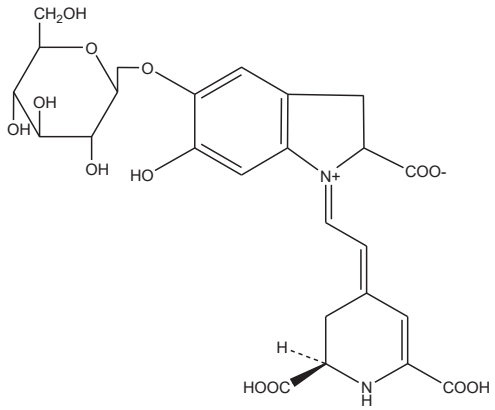
1. INTRODUCTION

Red betanin is a betalain pigment naturally occurring in the Red beet (Beta vulgaris) and is often found alongside the yellow pigment known as vulgaxanthin I [1]. Betanin is also the most abundant component of the processed beetroot juice [2].

Betanin ((2S)-1-{2-[(2S)-2,6-dicarboxy-2,3-dihydropyridin-4(1H)-ylidene]ethylidene}-5-(β-d-glucopyranosyloxy)-6-hydroxy-2,3-dihydro-1H-indol-1-ium-2-carboxylate) is a glycosidic dye formed from the combination of betanidin and the glucose aglycone. The betanidin is an iminium adduct of cyclo-dioxyphenylalanine (cyclo-DOPA) and betalamic acid ([4-(2-oxoethylidene)- 1,2,3,4-tetrahydropyridine-2,6-dicarboxylic acid) [1].

Betalains have antioxidant, anti-inflammation, lipid lowering, antidiabetic and anti-obesity properties [3]. Betanin is a natural colorant for food which provides the color red [4].

Various analytical techniques such as UV-Vis spectrophotometry, mass spectrometry, photoluminescence, FTIR and ^{1}H NMR spectroscopy are commonly used for betanin analysis [5-6].



Scheme 1. Structure of betanin

2. MATERIALS AND METHODS

2.1. Materials

Betanin is water-soluble and was extracted in water through solid-liquid extraction.

2.2. Analysis methods

FT-IR spectrum of this extract was recorded on a Bruker ATR ZnSe spectrophotometer, within the range of 4000-550 cm^{-1}, at room temperature with a spectral resolution of 2 cm^{-1}.

UV-Vis spectrum of the analyzed extract was recorded from 200-800 nm by using an UV-Vis Varian Cary 50 Bio spectrophotometer.

3. RESULTS AND DISCUSSION

The roots were used in order to extract betanin from red-beet. Finely chopped red beet were placed in an Erlenmeyer flask, and distilled water was added in a ratio of one part water to two parts beet. The mixture was heated for 60 minutes at 60 °C. The obtained extract was separated from the vegetable and was characterized using UV-Vis spectrophotometry and FTIR spectroscopy.

The aqueous extract was diluted 100, 150, and 200 times, and UV-Vis spectra were recorded, with an absorption peak observed at 533 nm, characteristic of betanin, in each case. As the concentration decreased, a decrease in absorbance was also observed, from 3.1 to 2.6 and 1.1, respectively.

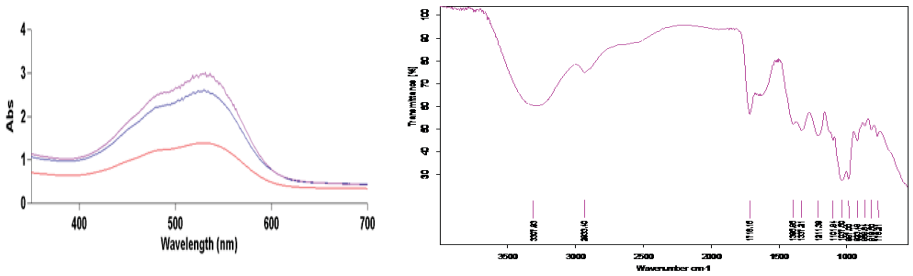


Figure 1. UV-Vis and FTIR Spectra of aqueous extract of betanin

The concentrated aqueous extract was subjected to analysis using FTIR spectroscopy. Since the analyzed sample contains a high amount of water, there is an intense absorption peak at 3307 cm^{-1}, characteristic of water molecules. At 2933 cm^{-1}, there is a peak attributed to the hydroxyl groups in the structure of betanin. The carbonyl bond is highlighted by a medium-intensity peak at 1716 cm^{-1}, and the ether linkage is indicated by an intense double-peak at 1037 cm^{-1} and 987 cm^{-1}.

4. CONCLUSION

The aqueous extract of betanin was separated from red beet using solid-liquid extraction. UV-Vis spectrophotometry and FTIR spectroscopy were used to characterize this extract.

REFERENCES

[1] I. Sadowska-Bartosz, G. Bartosz, *Mol.*, 26 **(2021)** 2520, doi.org/10.3390/molecules26092520

[2] A. Slavov, V. Karagyozov, P. Denev, M. Kratchanova, C. Kratchanov, *Czech J. Food Sci.*, 31 **(2013)** 139, doi.org/10.17221/61/2012-CJFS

[3] P. Calvi, S. Terzo, A, Amato, *Nat. Prod. Res.*, 37, **(2023)** 1746, doi.org/10.1080/14786419.2022.2106481

[4] B. G. Nabi, K. Mukhtar, W. Ahmed, M. F. Manzoor, M. M. Ali, N. Ranjha, M. Kieliszek, Z. F. Bhat, R. M. Aadil, *Food Biosci.*, 52 **(2023)** 102403, doi.org/10.1016/j.fbio.2023.102403.

[5] Y. Shang, X. Meng, J. Liu, N. Song, H. Zheng, C. Han, Q. Ma, *J. Chrom. A*, 1705 **(2023)** 464175, doi.org/10.1016/j.chroma.2023.464175.

[6] S. D. Sujitha, S. Jeyaram, *Indian J. Phys.*, **(2023)**, doi.org/10.1007/s12648-023-02908-4