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Leaching Processes applied for the Extraction of Betalain Colour Compounds from Microwave Oven-Dried Beetroot Leaf

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INTRODUCTION

Nitrogen-containing betalain colour compound which is known as natural chromo-alkaloid, abundantly found in Amarathacae species, has replaced the synthetic azo dyes in food processings recently. Betalains ($C_{24}H_{26}N_2O_{13}$) are the immonium derivatives of betalamic acid and are acidic in nature owing to carboxyl groups and are well known for their antioxidant and anti-inflammatory properties. They are normally coagulated in vacuoles of plant cells enclosed by tonoplast, vacuolar membrane, accompanying other phytochemical compounds. In this study, the contemporary approach for the leaching process of betalain colour compounds from microwave oven-dried beetroot leaf was realized with subsequent reasonable extraction techniques.

METHODS

- Continuous extractions were performed with the 50 % aqueous ethanol (1:50 leaf-to-solvent ratio) at 30 °C, 40 °C, 50 °C and 60 °C from 30 min to 120 min.
- Control samples were prepared with pure water and acidified water (citric acid) solvents.
- Meanwhile, the implementations of multiple extractions were done with the leaf-to-solvent ratio (1:50) at 30 °C for 30 min and the extractions were repeated three times with the fresh solvents. The applied solvents were 50 % aqueous ethanol, pure water, and acidified water.
- Total betalains (betacyanin and betaxanthin) contents in different extracts and their respective antioxidant activity were examined spectrophotometrically.

RESULTS

- Among the continuous extractions with varied temperature, the final leaf-ethanol (1:50) extract at 30 ºC exhibited the maximum amount of total betalains i.e, 31.99±0.5 mg·g^{-1} dry matter after 120 min of extraction time. The measured antioxidant activity was 109.21±0.69 mg ASE·g^{-1} dry matter (Figure 1).
- In the case of multiple extractions, the greatest amounts of betalains (30.36±1.74 mg·g^{-1} dry matter) withal antioxidant activity (83.12±7.95 mg ASE·g^{-1} dry matter) were recovered with 50 % aqueous ethanol after fluxing with fresh solvent for three times, i.e 90 min in total (Figure 2).
- As can be seen in the Figure 3, the scavenged amount of betalains differed according to the solvent type which is citric<distilled water<aqueous ethanol.

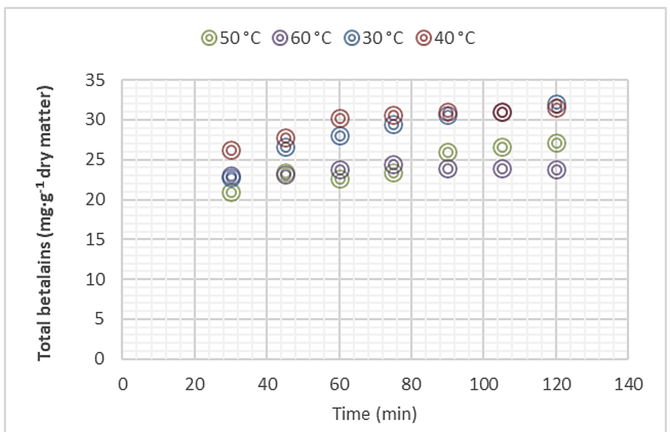

Figure 1 Continuous extraction of betalains

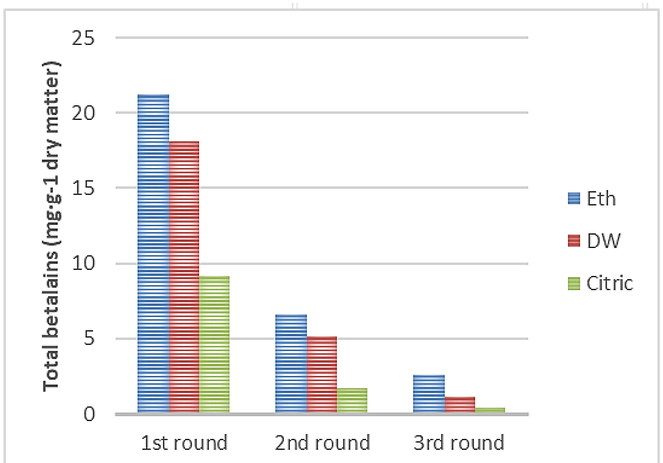

Figure 2 Multiple extraction of betalains

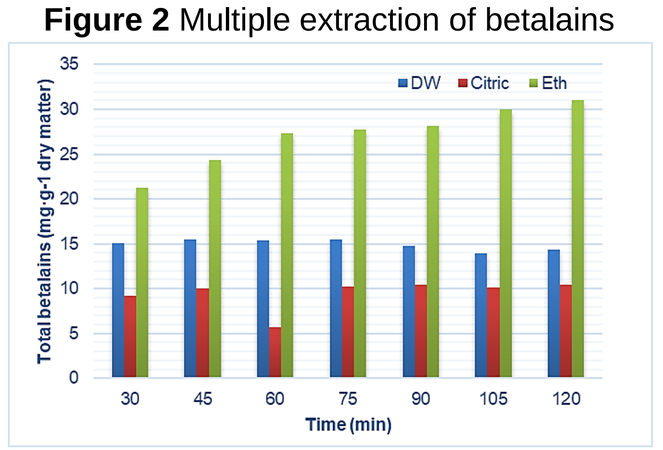

Figure 3 Effects of solvent variety on the extractability of betalains

CONCLUSION

To sum up, the recovered amounts of betalains were not significantly different between the two extraction techniques. The multiple extraction was preferable in terms of shorter extraction whilst continuous extraction has the privilege of less solvent consumption. In both extraction techniques, aqueous ethanol solvent was observed to be the most effective. Being a plant secondary metabolite with antioxidant-rich properties, the application of betalain colour compounds in food and pharmaceutical industries can be expected to be widened.

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