Efficiency of Microwave Irradiation on Volarization of Beetroot (*Beta vulgaris* L.) Waste

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Introduction

Despite the high instability of bio colors, the substitution of artificial dyes with them can balance their application in addressing health problems.

Beetroot (Beta vulgaris ssp. esculenta var. rubra L.), belongs to Chenopodiaceae (Amaranthaceae) family, is prominent vegetable ranked in topmost list of highly nutrient vegetables fortified with antioxidants such as polyphenols and betalains.

Betalain and phenolic, antioxidant-rich compounds responsible for host color and so commonly used as natural colorants in food and cosmetic industries, are copiously present in several kinds of fruits and vegetables as well as their wastes.
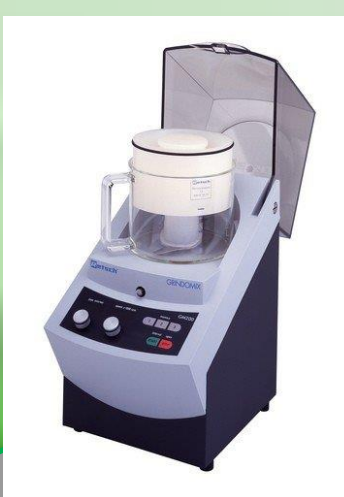
Materials and Methods

This study focused on the efficiency of microwave treatment on the extractability of bioactive compounds from Cylindra type beetroot (*Beta vulgaris* L.) peel by 15% aqueous ethanol. The extraction process was designed by the central composite design of response surface methodology (DOE) with four factors and three variables. Those experimental factors were microwave power (100-800 W), extraction time (30-150 s), peel-to-solvent ratio (0.1-0.2 w/v), and ascorbic acid percent (0.1-0.5 %). The determined dependent variables are total betalain compounds (TBC), total phenolic compounds (TPC) and antioxidant activity (AA). The following spectrophotometric analysis methods were performed to detect the presence of targeted bioactive compounds: Nilson's method (TBC), Folin-Ciocalteu method (TPC), and FRAP method (AA).

- ❑ **Cleaning**
- ❑ **Peeling**
- ❑ **Shredding**
- ❑ **Microwave-assisted-extraction**
- ❑ **Centrifugation**
- ❑ **Spectrophotometric analysis**

Results

The ANOVA results revealed the reliable outcomes with significant probability values along with the high F-values as well as overall R^2 values around 0.9 (Table 1).

Among thirty experimental runs, the maximum examined values of corresponding responses were as follows: TBC (1.94 mg/g of FW), TPC (43.78 mg/g of FW), and AA (61.58 mg/g of FW), respectively. Those highest outcomes were observed at different operational conditions of MAE.

Table (1) ANOVA for each corresponding variables which is built by DOE

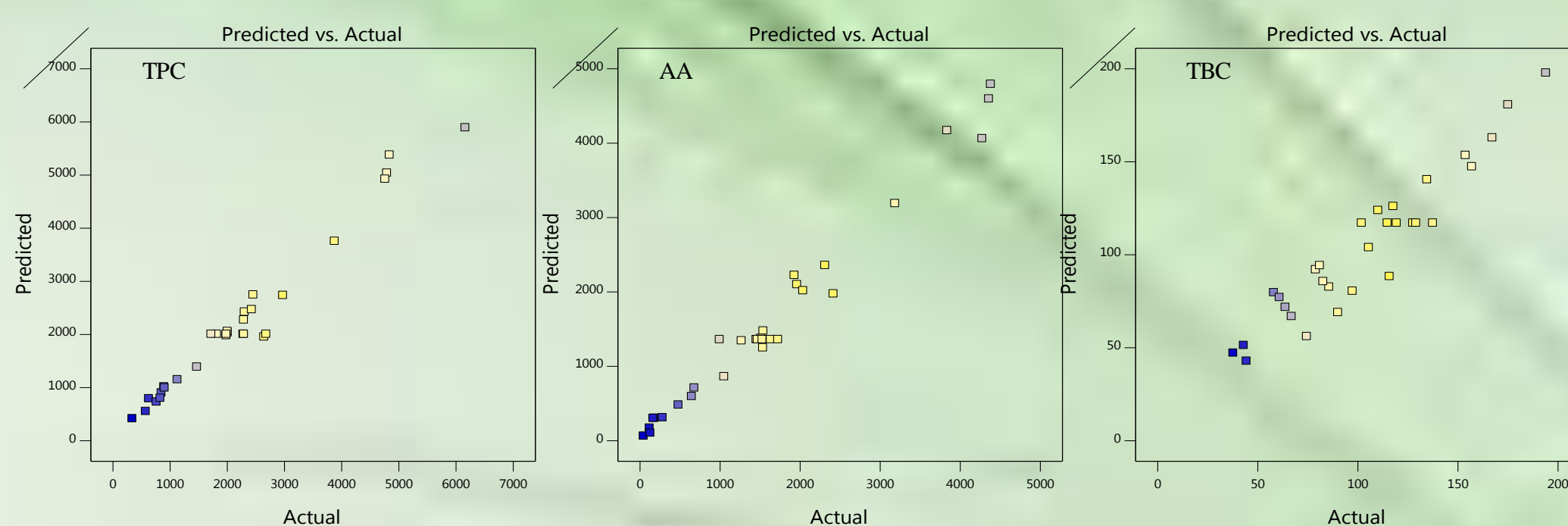| Model	Sum of Squares	df	Mean Square	F-value	p-value	Residual	Lack of Fit	R^2
TPC	6266.85	10	626.68	60.97	< 0.0001	195.31	121.47	0.97
AA	8168.79	10	816.88	75.86	< 0.0001	204.59	143.35	0.98
TBC	107.46	10	10.75	15.72	< 0.0001	12.99	11.34	0.89

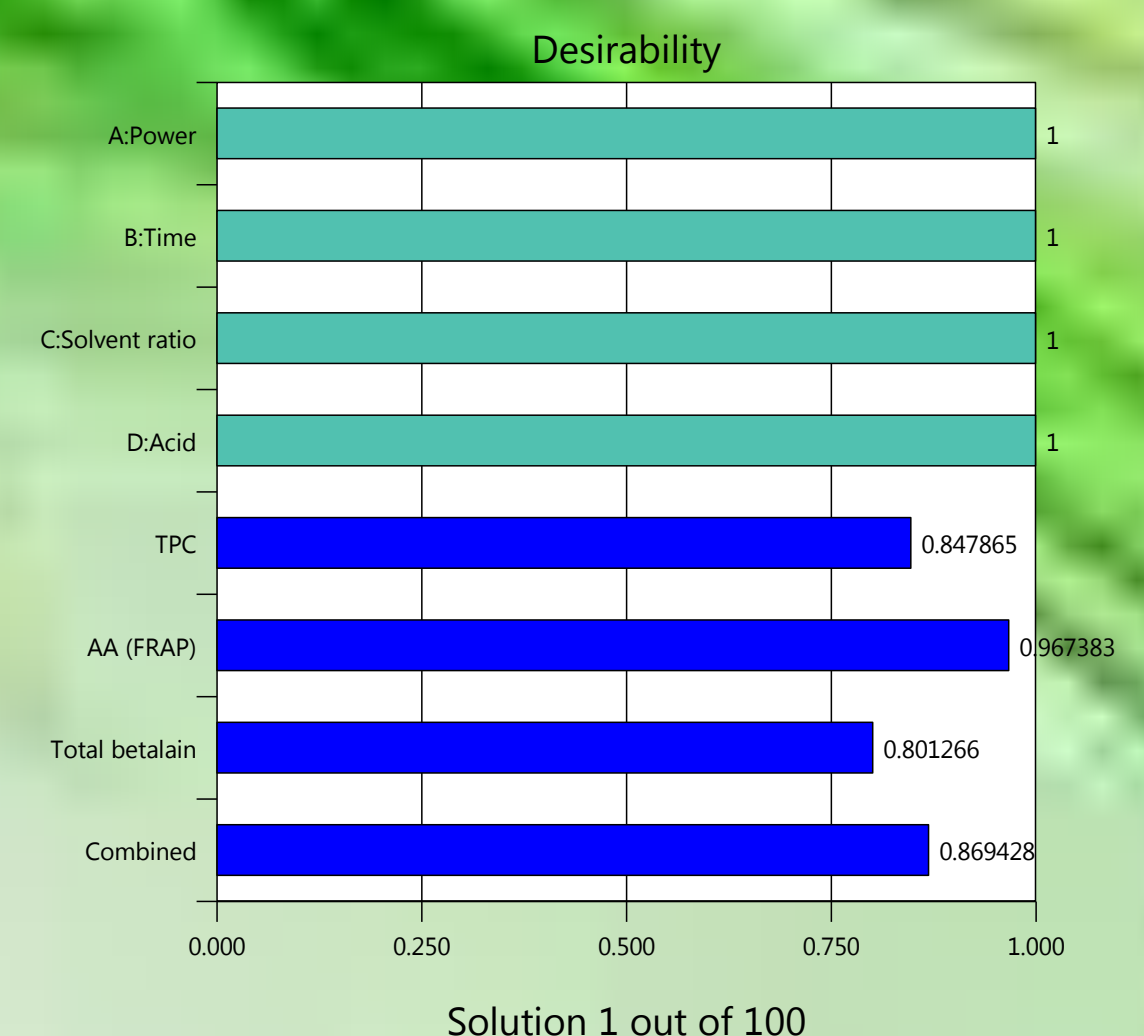**Fig (1)** Correlation between the predicted values and the actual values

Fig (2) Desirability test for each response

Conclusion

➢ Food waste treatment for bioactive compounds volarization and their potential application in food industries have been fulfilled recently.

➢ The need for thorough research to innovate the bioactive compound extraction using microwave seems to be efficient as the extracts revealed desirable amounts of specific bioactive compounds therein.