Common nettle processing residues as a valuable source of antioxidants


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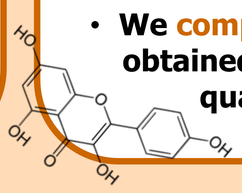
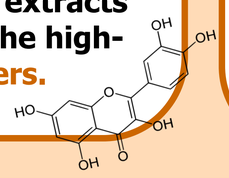
INTRODUCTION

- Among medicinal plants, **common nettle** is known as one of the richest sources of antioxidants.
- Nettle plants can be consumed in different ways, while it is commercially used in the form of **herbal tea.**
- In the nettle tea production process, a significant amount of chopped biomass is left behind, which is often discarded **without the valorisation of its full potential.**

- Therefore, we examined the possibility of **extracting antioxidants** from nettle biomass residues to create products of added value.
- Nettle leaves are rich in **quercetin, kaempferol, gallic and vanillic acid**, molecules with strong antioxidant activity (1).
- We **compared the characteristics** of extracts obtained from **nettle residues** and the high-quality biomass of **nettle flowers.**





- **Taguchi method** - implies the use of **orthogonal arrays** as a way of organizing the testing of process parameters (2).
- Instead of considering all possible combinations of parameters, this method examines pairs of combinations.
- We studied the effect of different extraction conditions: **solvent type, duration of ultrasonic treatment and temperature.**

Experiment	Levels		
	Ethanol : Distilled water proportion	Ultrasonic treatment (min)	Temperature (°C)
1	0 : 100	0	25
2	0 : 100	5	37
3	0 : 100	10	50
4	25 : 75	0	37
5	25 : 75	5	50
6	25 : 75	10	25
7	50 : 50	0	50
8	50 : 50	5	25
9	50 : 50	10	37

Taguchi experimental design

Nettle flower

Nettle residue

+ H2O
+ 25% EtOH
+ 50% EtOH

25°C
37°C
50°C

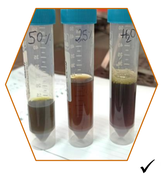
Extraction 24h, 172 rpm

0 min
5 min
10 min

Ultrasonic treatment, 90W

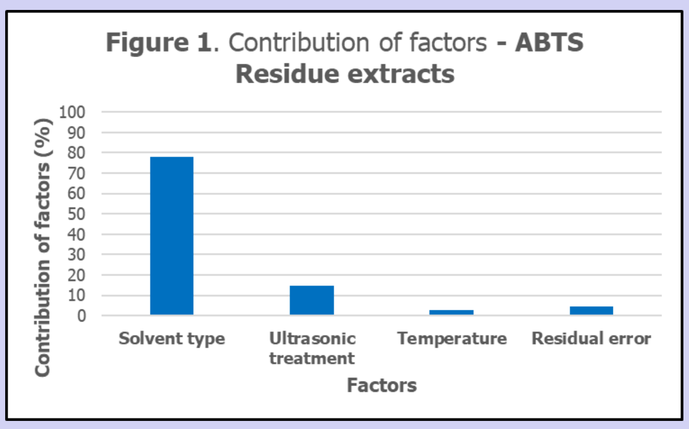
Centrifugation 6000 rpm, 10 min

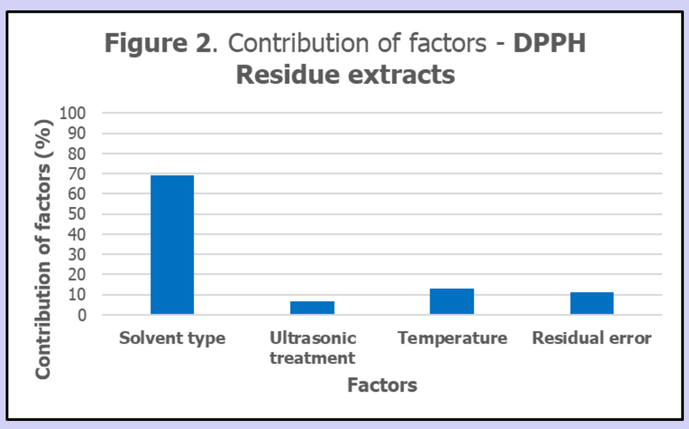
Vacuum filtration

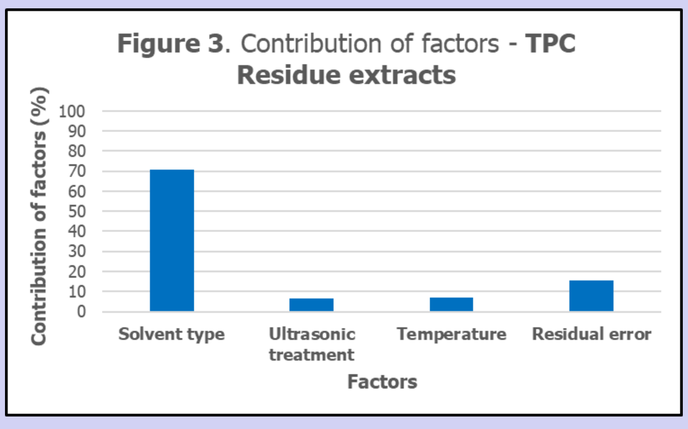


- ✓ ABTS
- ✓ DPPH
- ✓ Total polyphenolic content (TPC)

RESULTS AND DISCUSSION







Contribution of factors – ABTS

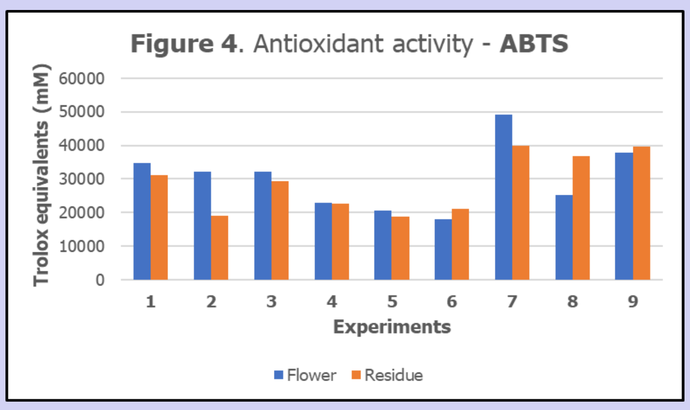
1. Solvent type (77.98 %)
2. Ultrasonic treatment (14.60 %)
3. Temperature (2.85 %)
4. Residual Error (4.57 %)

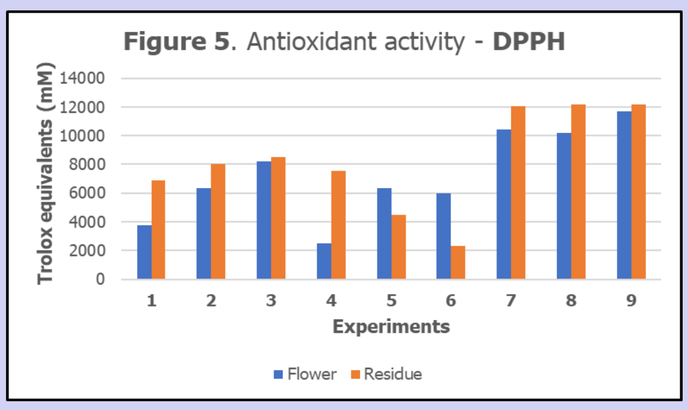
Contribution of factors – DPPH

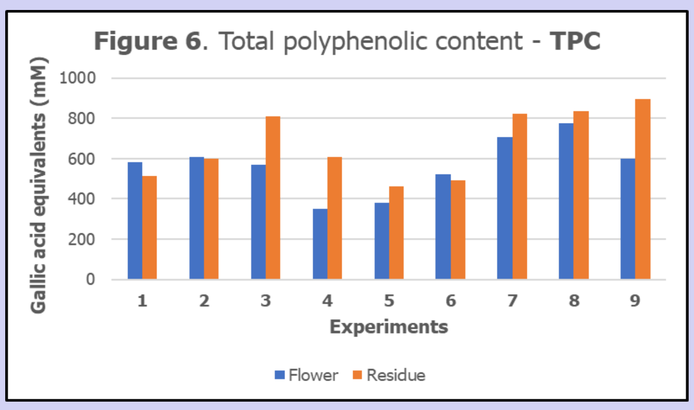
1. Solvent type (69.30 %)
2. Temperature (12.97 %)
3. Ultrasonic treatment (6.59 %)
4. Residual Error (11.14 %)

Contribution of factors – TPC

1. Solvent type (70.85 %)
2. Temperature (7.16 %)
3. Ultrasonic treatment (6.58 %)
4. Residual Error (15.41 %)







The optimal conditions for extracting antioxidants from nettle:

- **ABTS** - 50% EtOH, 0 min US treatment, 25°C → **18.58% less** than in flower extract
- **DPPH** - 50% EtOH, 0 min US treatment, 37°C → **4.25% more** than in flower extract
- **TPC** - 50% EtOH, 10 min US treatment, 37°C → **51.5% more** than in flower extract

CONCLUSIONS

- Nettle residue extracts proved as comparable or even higher in antioxidant activity to extracts obtained from nettle flower, considered the highest quality nettle biomass, used as a source of antioxidants for the food, pharmaceutical or cosmetic industry.
- The proposed extraction can be attractive for SMEs which are processing tea and can generate significant amounts of herbal wastes and residues

Acknowledgments

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