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Development of dry natural additives from stinging nettle (*Urtica dioica*) and evaluation of their quality and stability

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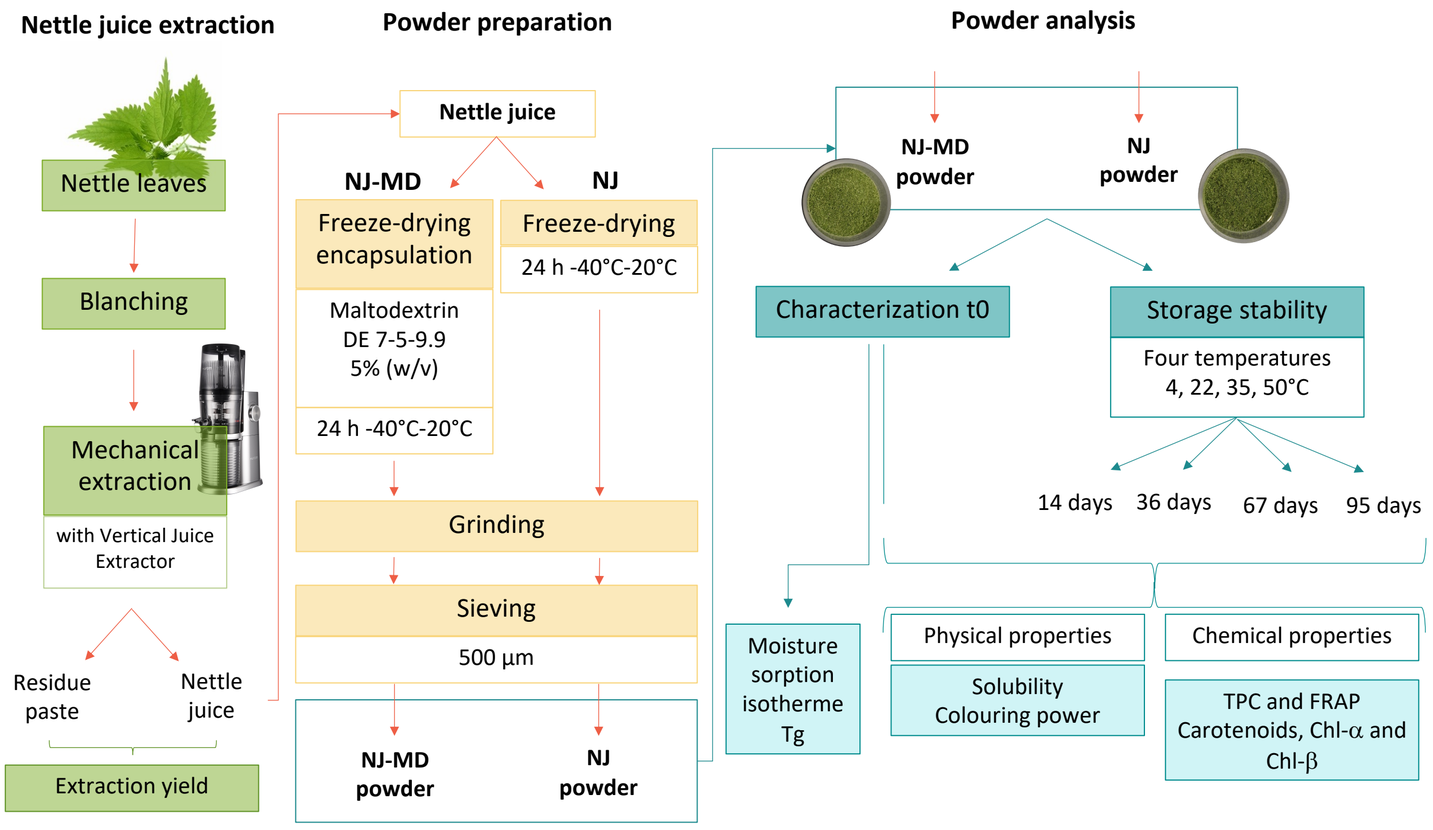
INTRODUCTION

Urtica dioica L., known as stinging nettle, is an underused wild plant used mainly for medicinal and traditional food purposes, and as colouring agent for the extraction of chlorophylls. Recently, it has received greater interest for its potential as a source of in vitro and/or in vivo bioactive molecules, such as chlorophylls, carotenoids and phenolic compounds. Despite its wide use as colouring ingredient, there is limited information on the preparation and stabilization of juices or extracts. This includes gentle extraction processes and drying in order to produce stable ingredients that are easy to handle and rich in bioactive compounds. For these reasons, the objectives of this study were to develop a new dry natural additive from freeze-dried nettle juice, with or without encapsulation with maltodextrin, and to study their quality and storage stability.

MATERIALS AND METHODS

Mechanically extracted nettle juice was subjected to freeze-drying without (NJ) and with the addition of maltodextrin (5 %, w/v) as a drying and encapsulating agent (NJ-MD). The differently obtained powders were characterized for their solubility in water, glass transition temperature (Tg), moisture sorption isotherm, colouring power, total phenolic content (TPC), ferric reducing antioxidant power (FRAP) and content of carotenoids, chlorophyll α (chl–α) and β (chl–β), and their storage stabilities were evaluated at four different temperatures (4°C, 22°C, 35°C and 50°C) for 95 days.



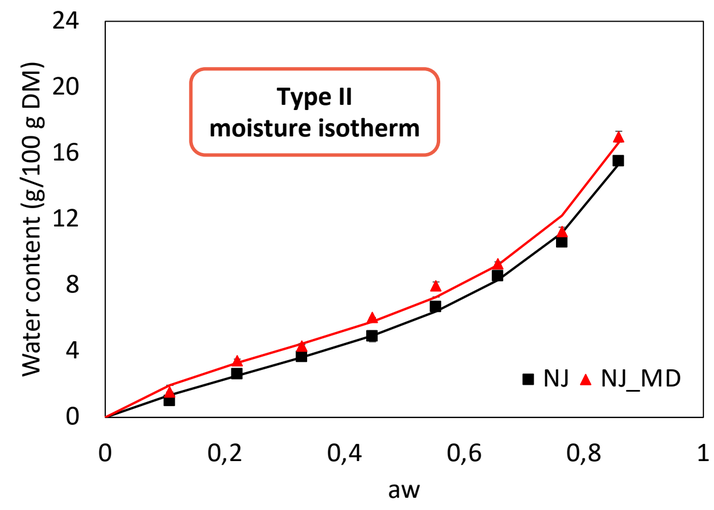
RESULTS

Characterization at time 0

	NJ	NJ_MD
Solubility (%)	19.13 ± 0.35	54.14 ± 0.34
Tg (°C)	44.24 ± 0.33	45.88 ± 1.32
Lightness (L*)	96.43 ± 1.20	97.87 ± 1.48
a*	-3.16 ± 0.07	-2.63 ± 0.08
b*	9.65 ± 0.32	7.84 ± 0.26
Chroma (C*)	10.15 ± 0.33	8.27 ± 0.27
Hue angle (h°)	161.85 ± 0.20	161.44 ± 0.09
TPC (mg GAE/g DM)	3.39 ± 0.09	2.37 ± 0.10
FRAP (µmol Fe^{2+}/g DM)	27.22 ± 0.44	20.65 ± 0.52
Carotenoids (mg/g DM)	2.33 ± 0.10	1.41 ± 0.08
Chlorophyll a (mg/g DM)	7.81 ± 0.31	4.50 ± 0.28
Chlorophyll b (mg/g DM)	2.14 ± 0.13	1.28 ± 0.10

➢NJ_MD compared to NJ showed higher solubility, lower values of C * and antioxidant capacity, and lower content of all bioactives as a consequence of the "diluting effect" given by the addition of maltodextrin.

➢NJ_MD and NJ showed sigmoidal moisture sorption isotherms (type II), with higher sorbed water at same a_W for NJ_MD.



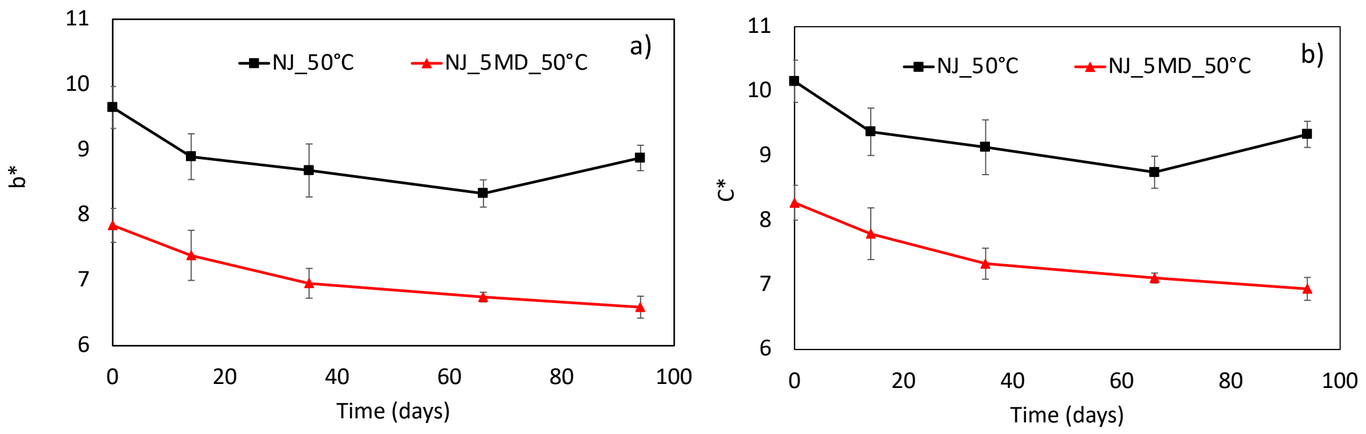
RESULTS

Storage stability

➢ **SOLUBILITY AND COLOURING POWER**:

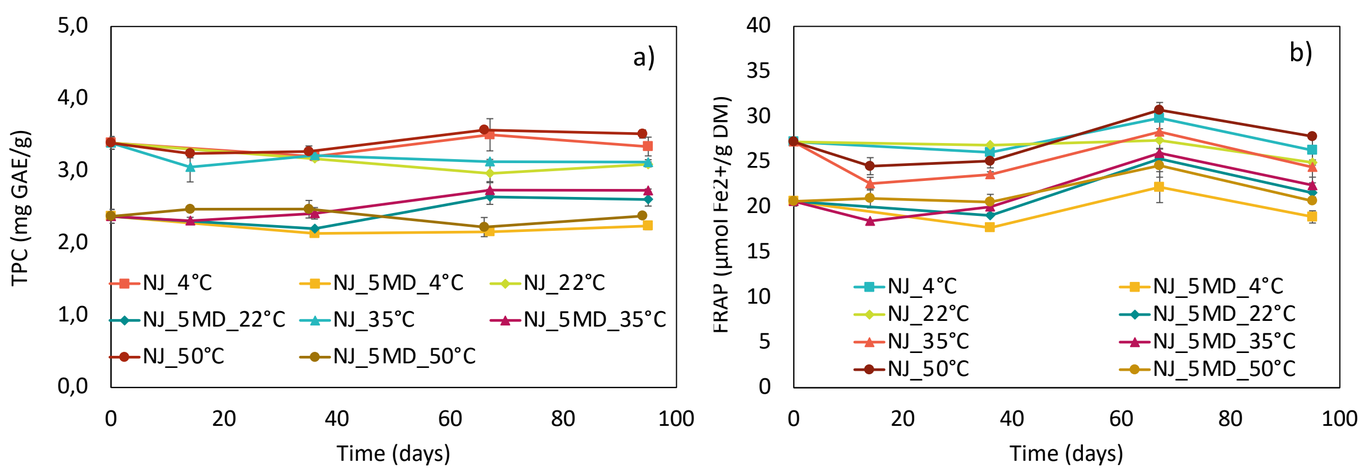
No significant ($p<0.05$) changes in solubility were observed during time for both powders and at all temperatures.

For both powders no significant changes ($p<0.05$) in h° and L* were observed while b* (a) and C* (b) decreased at the highest temperature.



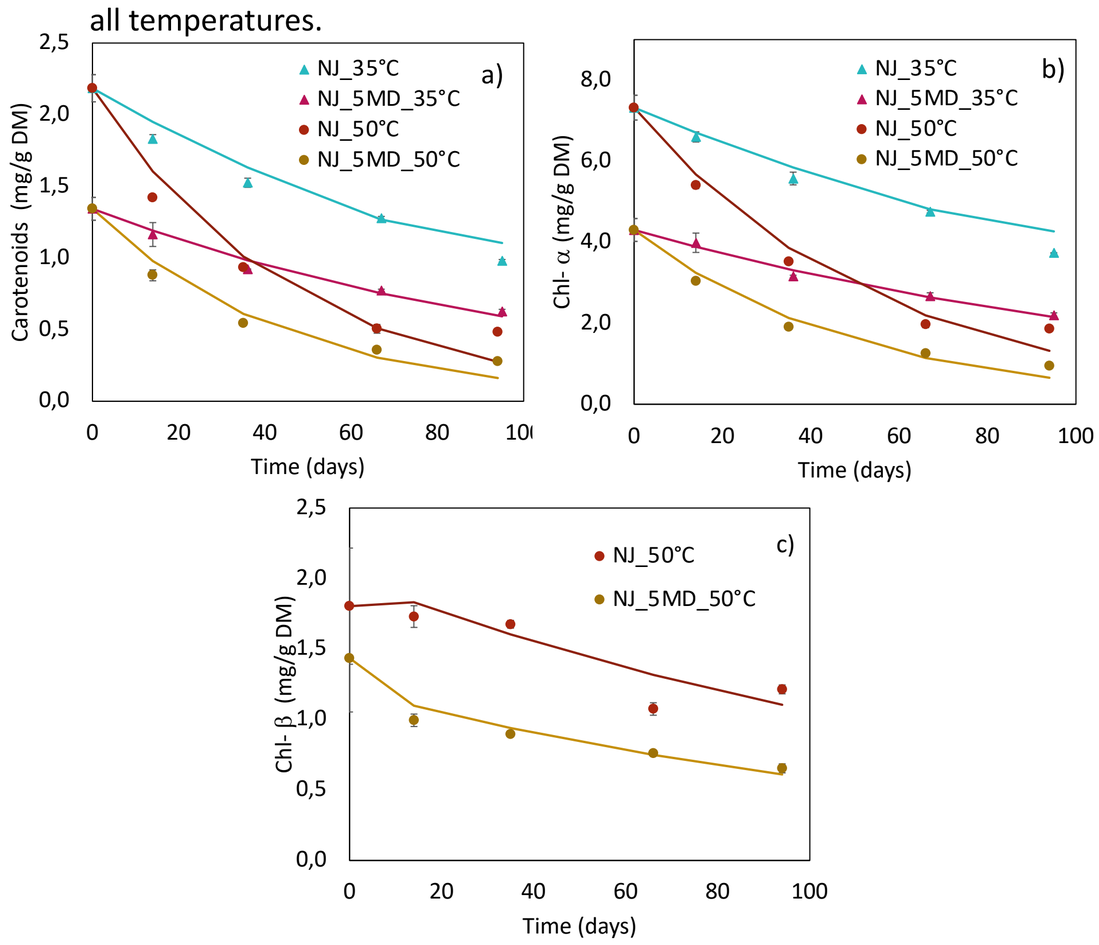
➢ **TPC (a) and FRAP (b):**

- No significant changes ($p<0.05$) for both powders at all temperatures.



➢ **CAROTENOIDS (a) and CHLOROPHYLLS (b-c)**

- The content of carotenoids and chlorophylls decreased during time depending on storage temperature.
- No significant changes were observed at 4 and 22 °C for carotenoids and chlorophyll α, and until 35 °C for chlorophyll β.
- Among pigments, chlorophyll β showed the lowest degradation also at high temperature.
- Both powders showed similar ($p>0.05$) pigment degradation kinetics at all temperatures.



CONCLUSIONS

This work highlights the possibility to obtain nettle dry ingredients by applying freeze-drying and freeze-drying encapsulation with maltodextrin, offering a new opportunity to use this plant for innovative food formulations and products.

ACKNOWLEDGMENT

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