Effect of the drying method on the composition of nettle leaf extract

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Arctic nettle

Stinging nettle (*Urtica dioica*) is a wild herbaceous perennial crop with food, feed, pharmaceutic/cosmetic, textile/building or agriculture applications.

Particularly, the health benefices of nettle leaves and roots have been known for a long time due to their high content of minerals, bioactive compounds and vitamins.

Nettle is a raw material which is attracting many interests and its cultivation is increasing in many European countries.

In our project **ARKNOKK ("Arktinen nokkonen, rikasta rahaksi")**, we are optimizing organic nettle cultivation **(Fig. 1)** and testing different nettle provenances. The possible use of nettle for winter supplementary feed for reindeer is also presented in the poster by Ranta et al.

In Finland, nettle is mainly cultivated for food and feed applications. After harvest, nettle leaves need to be processed rapidly to limit fermentation. Typically leaves are **dried**, but **fresh frozen** leaves are also required for specific products.

In this work, we tested the effect of different drying methods on the composition of bioactive compounds and nitrate (NO_3) in leaf extracts.

Methods

Leaves have been collected from wild populations in Oulu area in late June 2022. Different drying methods were tested:

- **Freeze drying (FD)** after freezing (reference method)
- **Air drying 40 °C or 70 °C**
- **Blanching** (boiling water for 1min followed by freezing, and then freeze drying),
- **microwave drying:** leaves dried in microwave at 900W 2x2min (**Micro1**) or 450W 2x3 min (**Micro2**).

Fresh leaves were also extracted immediately after harvest.

For all other treatments, dry leaves were grinded into fine powder, extracted in methanol 80% and analyzed for their **phenolic and carotenoid composition** using liquid chromatography. **NO_3 content** was quantified spectrophotometrically using the salicylic/sulfuric acid method. The **radical scavenging activity (RSA)** was measured using DPPH as a substrate.

The whole experiment was replicated 3 times with leaves collected on the 21, 27 and 28.6.2022 at Oulu University. For each replicate, values were standardized to the freeze-dried treatment. Values are means ±SD, n=3).

Figure 1. Stinging nettle cultivated in Lappia Loue, Tervola (ARKNOKK experimental plots)

Results

- Soluble phenolic in nettle leaves are composed of about **10% flavonols and 90% hydroxycinnamic acids (HCAs)**, with caffeoyl malic and chlorogenic acids representing 60 and 21%, respectively. In FD leaves, 23 mg of phenolics and 0.46 mg of carotenoids were measured per g of DW.
- The **antioxidant activity**, measured as the radical scavenging activity (**RSA**) was strongly correlated with the phenolic composition, and especially HCAs (**Fig 2**).
- Air drying at 40 °C and microwave drying did not significantly affect the phenolic composition of leaf extracts but drying at 70°C, and especially blanching are drastically decreasing the phenolic content compared to FD (**Fig. 3**). The RSA was similarly affected (not shown). Values from fresh leaves are only indicative (extraction not fully quantitative).
- The carotenoid concentrations were not affected by any of the treatment (not shown)
- The **NO_3** concentration (2.03 mg/g DW in FD) was drastically decreased after blanching (**Fig. 4**).

☞ **Blanching** fresh leaves can help preserving the green color and reduce NO_3 concentration, but it also reduces the antioxidant properties drastically.

☞ **Microwave drying** appears as an interesting and fast method to preserve raw material properties.

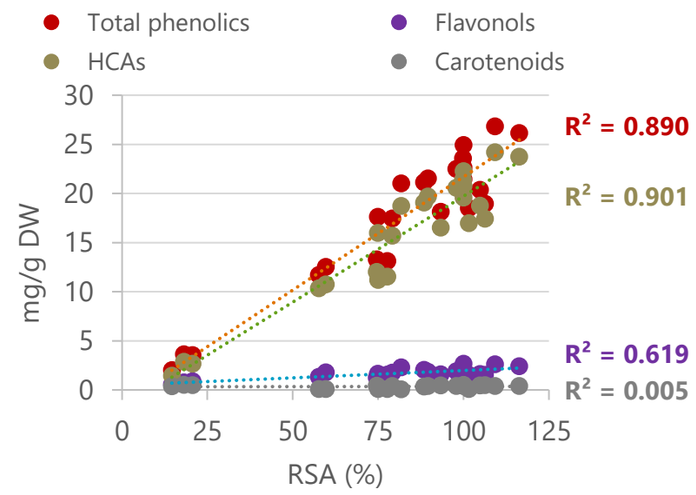

Figure 2. Correlation between the **RSA** (FD=100%) and the different compounds (mg/g DW) in nettle leaf extracts.

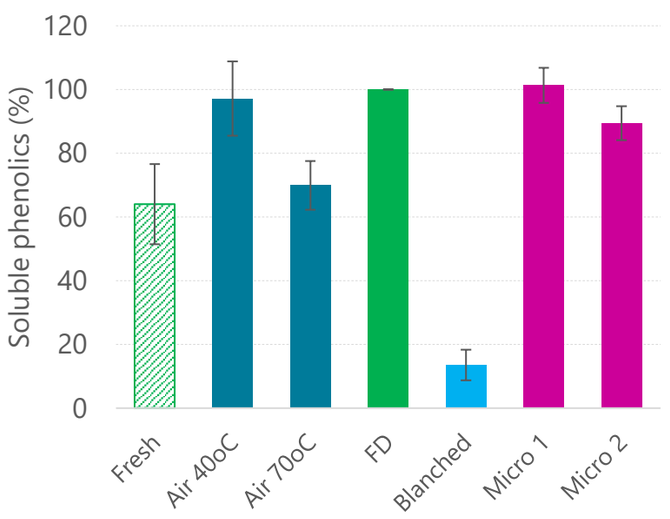

Figure 3. Effect of the drying method on the soluble **phenolic** concentrations in nettle leaf extracts (FD=100%)

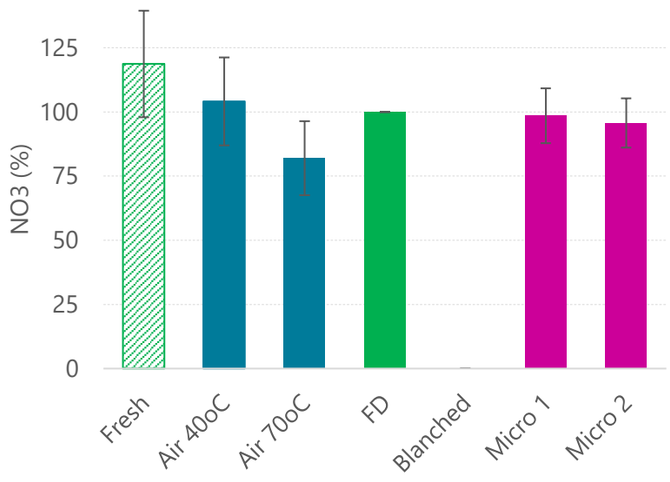

Figure 4. Effect of the drying method on the **NO_3** concentrations in nettle leaf extracts (FD=100%)

The post-harvest processing method of nettle leaves can affect a lot the concentration of bioactive compounds. The method used has to fit the final use of the raw material.

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