Foods 2024 Conference

The 5th International Electronic Conference on Foods

28–30 October 2024 | Online

MDPI

VALORIZATION OF FENNEL LEAVES AS SOURCE OF BIOACTIVE COMPOUNDS: EFFECTS OF DEHYDRATION ON NUTRITIONAL AND FUNCTIONAL PROPERTIES

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INTRODUCTION & AIM

Fruit and vegetable food industries face a major problem, the generation of large amounts of waste, also called food by-products. Fennel is a very aromatic plant, which has a characteristic anise-like flavor. In particular, fennel leaves are rich in bioactive compounds such as phenolic acids, tocopherols, flavonoids and chlorophyll. The aims of this research were to study the effect of convective dehydration on total phenolic (TPC), flavonoid (TFC) and chlorophyll contents (TC). Moreover, drying kinetics modelled by mathematical expressions as well as functional properties (antioxidant and anti-diabetic capacities) were determined in order to add value and revalorize the fennel leaves as natural sources of functional ingredients.

METHODS

Dehydration was conducted at 50, 60 and 70°C using a convective oven with a constant air flow rate of 5.0 ± 0.1 m/s. TPC (Folin-Ciocalteu), TFC (spectrophotometric method) and TC (spectrophotometric method) were measured. Antioxidant capacity was determined using DPPH method, and anti-diabetic capacity was assessed by alpha-glucosidase inhibitory activity (spectrophotometric method). Midilli-Kukuk model was applied to simulate experimental drying curves.

Fresh fennel

Dehydrated fennel

RESULTS & DISCUSSION

Table 1	TPC (mg EAG/100g dm)	TFC (mg E quercetin/100g dm)	α-glucosidase inhibition (%)	DPPH (mg TE/100 g dm)	TC (mg/g ms)
Fresh samples	2250.19 ± 80.08^{a}	11582.63 ± 614.99^{b}	25.98 ± 1.06^{d}	3448.60 ± 11.88^{a}	778.01 ± 90.98^{e}
Dehydrated at 50ºC	638.46 ± 30.23^{c}	2623.58 ± 16.60^{d}	79.47 ± 1.22^{a}	483.45 ± 2.43^{d}	1913.25 ± 87.15^{b}
Dehydrated at 60ºC	917.11 ± 30.26^{b}	5597.38 ± 35.2^{c}	69.57 ± 1.66^{b}	433.62 ± 9.77^{d}	1326.11 ± 96.77^{c}
Dehydrated at 70ºC	922.65 ± 73.43^{b}	6095.81 ± 90.60^{c}	47.31 ± 0.79^{c}	1203.01 ± 3.86^{c}	1196.18 ± 35.24^{d}

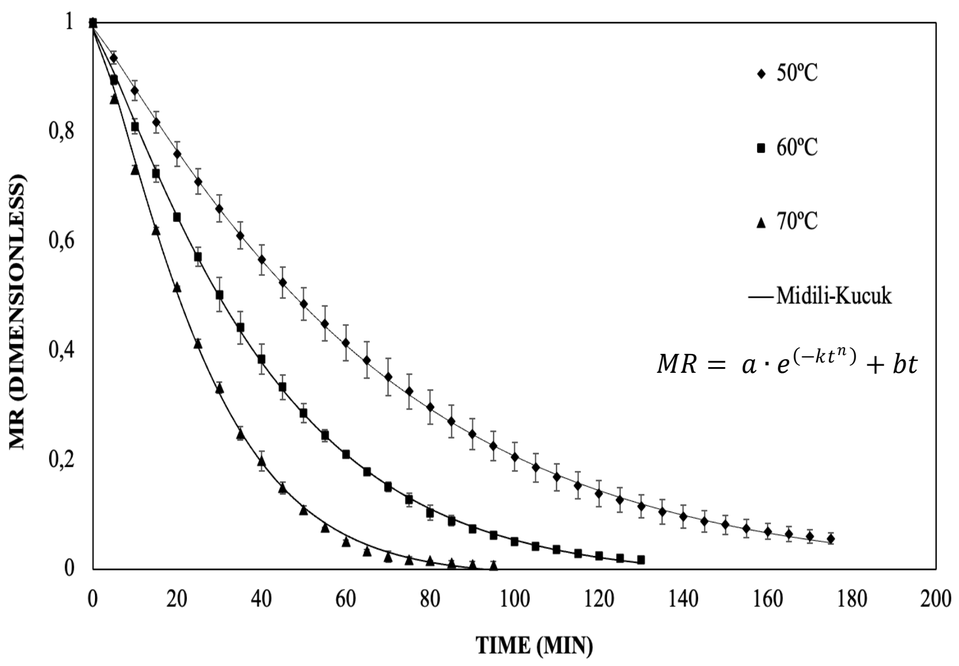

Figure 1. Experimental and simulated (Midilli–Kucuk) drying curves of fennel leaves (n=3). Xf= 15%. MR=X/Xo.

- As expected, the drying time to reach a similar moisture content (15%) decreased as the drying temperature increased (Fig. 1). Midilli–Kucuk model provided an excellent fit to all the experimental drying curves (R^2= 0.992).
- Drying temperature had a significant effect on the phenols and flavonoids contents related to control. Working at 70ºC and 60ºC did not show significant differences ($p<0.01$). Chlorophyll content in dried samples increased compared to control, but as the drying temperature increased, the chlorophyll content decreased ($p<0,01$) (Table 1).
- Table 1 also presented biological activity of extracts. Dehydrated samples presented a decreased in antioxidant capacity related to fresh samples. However, dehydration at 70ºC showed a higher value than values at 50 and 60ºC. As can be seen in Table 1, the antidiabetic capacity increases with dehydration, being higher at 50ºC.

CONCLUSION

The results of this investigation indicate that fennel leaves, which are discarded nowadays, are excellent sources of bioactive compounds with relevant biological activities. Therefore, fennel leaves extracts are potential functional ingredients to replace synthetic food additives in order to design innovative functional food products.

FUTURE WORK / REFERENCES

These are preliminary investigations that require more studies to determine its appropriate use in food industry in terms of doses level, type of enrichment (microencapsulation), sensory characteristics, interaction with other ingredients, etc.

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