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Far Infrared drying effects on drying kinetics, energy consumption and antioxidant properties of *Gymnema sylvestre* R.Br. leaves

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Abstract

Gymnema sylvestre R.Br. is a medicinal plant widely used to treat diabetes mellitus and used as a natural antioxidant. The dried powder of this plant is used in the Ayurvedic system of medicine as an alternative to fresh leaves. Far infrared (FIR) can be a potential source to dry herbs as it rapidly transfers the heat and provides uniform heating without heating the air. Although the antioxidant properties of dried leaf extract of *G. sylvestre* are studied, applicability of FIR for drying this plant has not been tested. Therefore, this study was undertaken to investigate the impact of FIR (ceramic type) on drying characteristics, colour and antioxidant activity of leaves of *G. sylvestre*. Fresh leaves were dried under four temperatures (125, 150, 175 and 200 °C) and drying times (5, 10, 15 and 20 mins) and weight changes, energy consumption and colour changes were measured for five replicates. The water-ethanol extract was prepared and total phenolic compounds (TPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity and ferric-reducing power (FRAP assay) were investigated. The results revealed that significant ($P < 0.05$) effect of temperature and drying time on drying kinetics, specific energy consumption (SEC) and antioxidant activity. With temperature and time, drying rate and total colour change increased whilst SEC decreased. The Leaves dried under FIR showed significantly ($P < 0.05$) higher TPC than fresh leaves. The TPC continuously increased with drying time at low temperatures (125 & 150 °C). However, under high temperatures (175 & 200 °C), TPC increased up to 15 minutes and significantly ($P < 0.05$) decreased at 20 minutes. A similar trend for DPPH and FRAP values with time was observed under low and high temperatures. The strong correlation of TPC with DPPH and FRAP ($r = 0.93$ and 0.86 , respectively) revealed that TPC mainly involves with antioxidant activity of the leaves. The highest TPC, DPPH and FRAP values were reported for leaves dried under 200 °C for 15 minutes. The results showed that FIR drying is conducive for drying of *G. sylvestre* as it increased the antioxidant properties. Further research is needed to investigate the potential of intermittent FIR drying for reducing the specific energy consumption (SEC) during the drying of *G. sylvestre*.

Keywords: Colour changes, DPPH, Energy consumption, Far infrared, Total phenolic compound

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