



SOLAR DRYING OF SOME AGRICULTURAL PRODUCTS UNDER FAYOUM CLIMATIC CONDITIONS

By

Tarek Khames Abd El-kader Abd El-Mageed

B.Sc. in Agric. (soils and water), Faculty of Agriculture,
Fayoum University, 2010

THESIS

Submitted in Partial Fulfillment

Of

**The Requirements for the Degree of
Master of Sciences**

In

**Agricultural Sciences
(Agricultural Engineering)**

Department of Soils and Water
Faculty of Agriculture

FAYOUM UNIVERSITY

2015

ABSTRACT

Two similar solar drying units were designed and constructed for drying peppermint and basil leaves under Fayoum conditions at two periods in August, 2014 for peppermint (*Mentha viridis L.*) from 11 to 14 August, 2014 and for basil (*Ocimum basilicum L.*) from 21 to 24 August, 2014. Each drying unit consists of a solar collector, which oriented and tilted at latitude tilt angle (30°) and attached with drying chamber. The drying experiments were carried out to examine the effect of peppermint and basil leaves depths (2, 4 and 6 mm) and airflow rates (0.015 and $0.025 \text{ m}^3 \cdot \text{s}^{-1}$) on peppermint and basil leaves drying rate.

The obtained results indicated that, the tilted surface of the solar collector increased the amount of the total daily average solar radiation by 24.59% and 25.51% for the first and second drying periods of peppermint and basil leaves, respectively. The higher outlet air temperatures (drying temperature cycles) were obtained at the lower airflow rate ($0.015 \text{ m}^3 \cdot \text{s}^{-1}$) and vice versa. The values of solar energy gained and the thermal efficiency of the solar collector were relatively higher at the higher airflow rate as compared with those for the lower airflow rate. The final average moisture content of peppermint leaves were 12.97 % (d.b.) and 12.88% (d.b.) at the airflow rates of 0.015 and $0.025 \text{ m}^3 \cdot \text{s}^{-1}$, respectively. While the final average moisture content of basil leaves were 13.22 % (d.b.) and 11.52 % (d.b.) at the airflow rates of 0.015 and $0.025 \text{ m}^3 \cdot \text{s}^{-1}$, respectively. The drying effectiveness had less value at all peppermint and basil leaves depths at airflow rate of $0.025 \text{ m}^3 \cdot \text{s}^{-1}$ than those at air flow rate $0.015 \text{ m}^3 \cdot \text{s}^{-1}$. The 4-cm plant leaves depth had the least values of drying effectiveness (0.242 and 0.172 h/g

moisture) at airflow rate $0.025 \text{ m}^3 \cdot \text{s}^{-1}$ for peppermint and basil leaves, respectively. Two equations were developed by the Excel-2010 soft-ware to obtain the relationship between drying rate (g moisture/h) and leaves depth at two airflow rates (0.015 and $0.025 \text{ m}^3 \cdot \text{s}^{-1}$) for peppermint and basil. All the depths of peppermint and basil leaves dried by heated air using solar energy had higher total chlorophyll (mg/100g) than the same depths of peppermint and basil leaves dried directly by the sun (natural drying). On the contrary, all depths of peppermint and basil leaves dried by heated air using solar energy had less oil content (%) than the same depths of peppermint and basil which dried directly by the sun (natural drying). Under the condition of this study, it can be concluded that, the optimum depth for drying medicinal and aromatic plants in the solar dryer is 4 cm.