High temperature mechanical drying of field peas *(Pisum sativum, L)*

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Abstract

Drying characteristics of field peas *(Pisum sativum, L)* at 80° C showed steeper drying rate when compared to low temperature drying. The higher initial moisture content samples had steeper drying characteristics than the low moisture content field pea samples. The drying rate for field peas at 80" C was higher throughout the drying period as compared to drying rates at lower temperature for all initial moisture contents.

Introduction

Drying of cereals, oilseeds and pulse grains are necessary to improve their storability and preventing loss of quality during subsequent processing, [Booker et. al 1974). The loss of grains are affected at various stages such as in the field, at harvest, shelling, handling, drying and storage. The variability of physical and biological characteristics of grains such as size, structure, morphology, nutritional value and textural characteristics are affected during drying, [Mohsenin, 1986). Salunkhe et *al.* (1985) have reported that storage conditions may adversely affect the cooking quality and nutritive value of legumes. Tang et *al.* (1993) reported that lentils dried at 80" C lost all viability. The seed properties such as hardness, viability, germination, colour, breakage and cooking time for pulse crops are indices that varies with drying temperature as reported on the artificial drying quality of lentils, (tang and Sokhansanj, 1991). The susceptibility of lentil seeds to breakage was shown to be affected by moisture content and temperature, [Tang *et al.* 1991).

Pulse crops such as lentils, field peas, chick peas are rich in protein, starch and the quality of fiber obtained from the seed coats are used in the feed industry. Pulses such as bean contain a number of antinutrients and potentially toxic substances; which include trypsin inhibitors, hemagglutinins or lectins, goitrogenic factors, cyanogenic glucosides and lathyric factors. Preconditioning treatments such as heating, steaming and microwave heating are used to separate the seed coat from the cotyledons of the pulses. In addition to inactivating antinutritional components, microwave heating has the direct potential for use as a preconditioning treatment for common dry beans to reduce processing time, (Uebersax, 1991). Drying of heat sensitive herbs such as eichenicia and borage are prone to heat damage. Seeds of herbs such as eichenicia, *(Eichenicia purpurea* (L)] are harvested as the moisture content drops less than 20 percent and dried with forced air, heated or unheated air at 40" C [Bertalan, 1991). The objective of this paper is to study the thin layer drying characteristics of field peas at drying air temperatures of 50, 60, 70 and 80" C for various initial moisture contents.

Methods and materials

Field peas (Trapper cv) at moisture contents 13.4 %, 18.4 %, and 21.1 % w.b.

were obtained by drying field peas from 24.7 % at 40” C using lab model hi-speed dryer, (Lab-line Instuments, Il, USA). 100 g samples of field peas in duplicates were dried to a final moisture content of 9 % w.b. Psychrometric properties of drying air and sample surface temperature of field peas were continuously monitored. The drying air temperature varied at $\pm$ 1.5” C during the experiment. The relative humidity was maintained at 15 $\pm$ 2.0 %. Thin layer drying characteristics were studied as the plot of moisture removal rate and time. The results were analysed using Excel software.

Results and Discussion

Fig. 1 shows thin layer drying characteristics of field peas studied at 50, 60, 70 and 80” C for the initial moisture content at 13.4 % observed during 400 minutes of drying. Drying field pea kernels at 80” C decreased the drying duration effectively to half the time required to bring the moisture content to 9 % compared to drying at 50” C. Fig. 2 shows the variation between two successive trials conducted at 50” C. The duplicate trial represented the actual conditions. Fig. 3 and Fig. 4 shows the drying characteristics of field peas for initial moisture contents, at 18.4 % and 21.1 %, and similar trends were observed. The steepness of the slope increased progressively as the drying temperature increased from 50” C to 80” C. Fig. 5 shows the rate of moisture removal for different temperature of drying at 13.4 % moisture content. The drying rate varied from 0.00055 g moisture/g dry matter/min at the beginning of the experiment to 0.0004 g moisture/g dry matter/min to the end of the experiment for drying air temperature of 80^0 C, whereas the drying rate was 0.00025 g moisture/g dry matter/min for the drying air temperature of 50” C. Higher initial drying rates were observed for higher initial moisture contents. Fig. 6, Fig. 7 and Fig. 8 shows that the initial drying rate was higher for higher temperature and higher moisture content. The drying rate characteristics did not significantly differ at low temperature drying for higher initial moisture content sample.

Conclusion

Drying characteristics of field peas at 80” C showed steeper drying rate when compared to low temperature drying. The higher initial moisture content samples had steeper drying characteristics than the low moisture content pea samples. The drying rate for field peas at 80” C was higher throughout the drying period as compared to drying rates at lower temperature for all initial moisture contents.

References

Mohsenin N.N. 1986. Physical properties of plant and animal materials. 2nd ed.

Booker, D.B., F.W. Bakker-Arkema, and C.W.HalL 1974. Drying cereal grains. Avi Publishing Co., Inc. Westport. CT.

Bertalan, G. 1991. Harvesting and cleaning herb seeds. The herb, spice, and medicinal plant digest. University of Massachusetts, USDA publication, Vol. 9 (3).

Wartidiningsih, N and R.L. Geneve. 1994. Seed source and quality influence germination in purple coneflower ***(Eichenicia purpurea*** (L) Moench.) Horticultural Science, 29(2): 1443- 1444.

Sathe, S.K. and Salunkhe, D.K. Technology of removal of unwanted components of dry legumes. *In CRC Handbook of World Legumes. Vol III.*

Uebersax, M.A., Ruengakulrach, S., and Gccena, L.G. 1991. Strategies and procedures for processing dry beans. Food Technology, 104-l 11.

Tang, J. and Sokhansanj, S. 1993. Drying paramater effects on lentil seed viability. Transactions of the ASAE. Vol. 36 (3) : 855-861.

Tang, J., Sokhansanj, S, Sosulski, F.W., and Slinkard, AE. 1991. Canadian Institute of Science and Technology, Vol. 24 (5) : 283 - 286.

Tang, J., Sokhansanj, S and Sosulski, F. 1991. Determination of the breakage susceptibility of lentil seeds. Cereal chemistry. Vol. 68 (6) : 647-650.

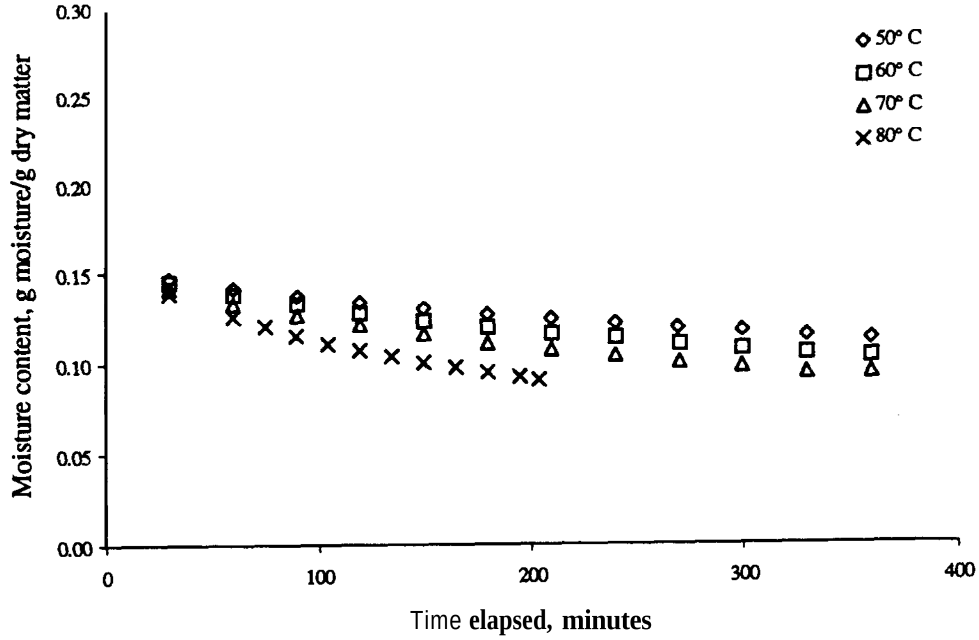

Fig. 1 Drying characteristics of field peas at 13.4 % w.b. initial moisture content for drying air temperatures of 50° C to 80" C.

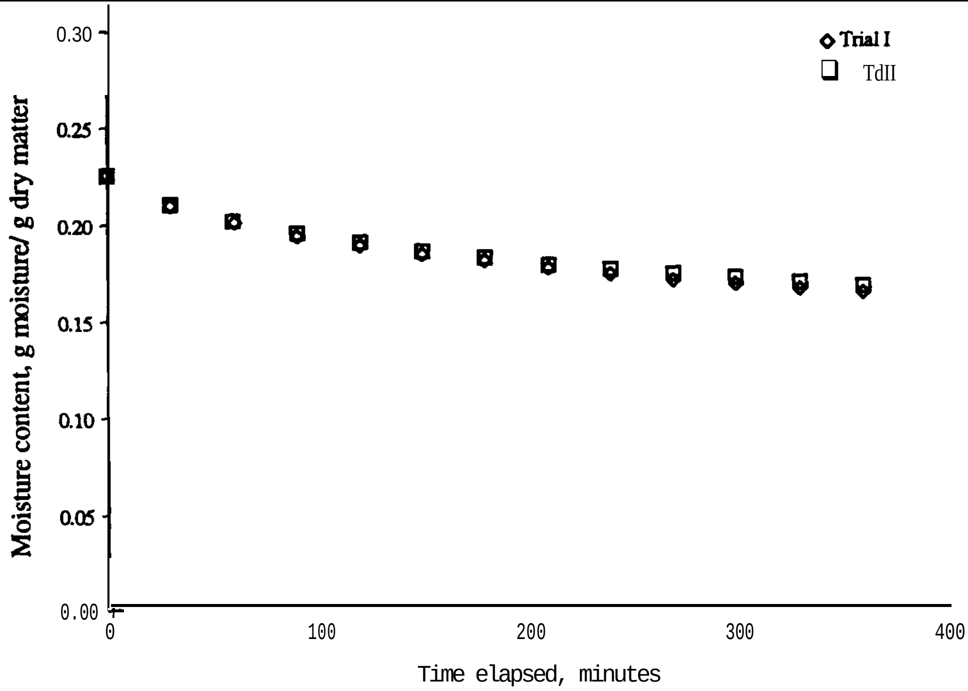

Fig. 2 Drying characteristics of field peas at 18.4 % w.b. initial moisture content, at 50" C during two successive trials.

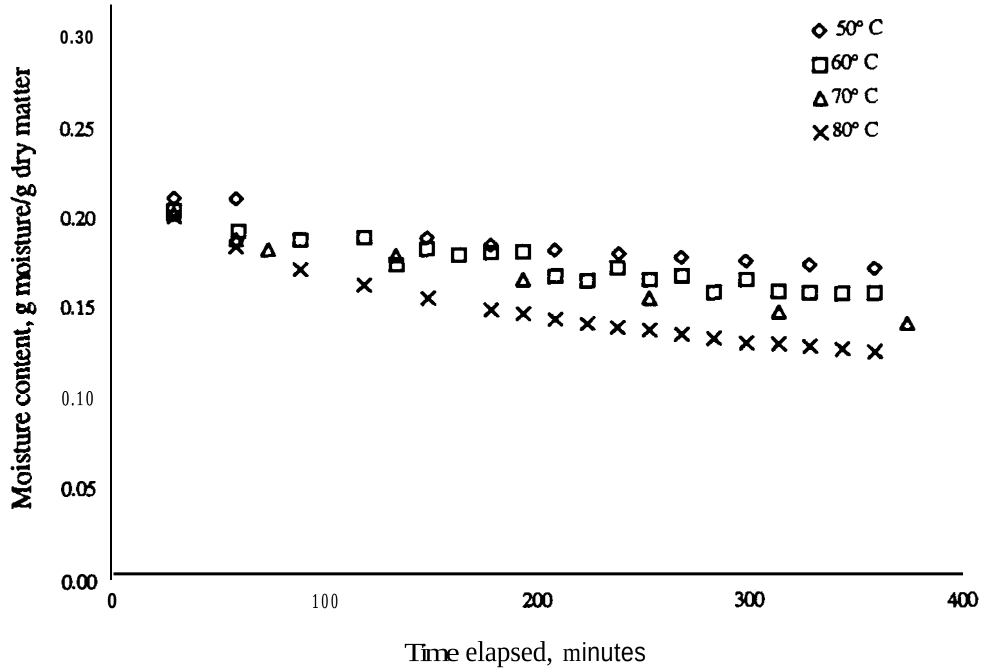

Fig. 3 Drying characteristics of field pea at 18.4 6 initial moisture **content at drying air temperatures of 50" C to 80" C**

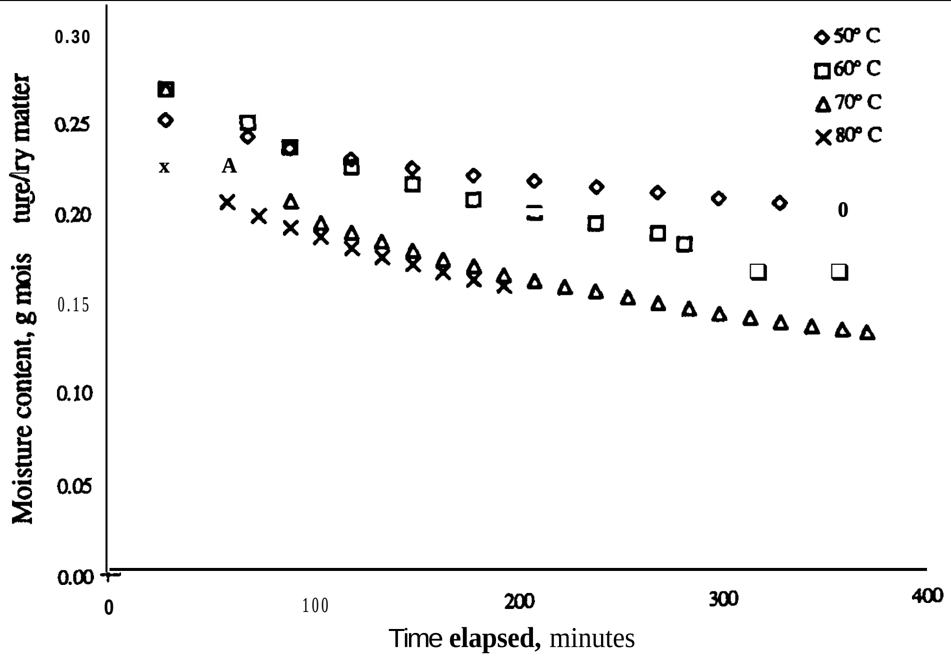

Fig. 4 Drying characteristics of field peas at 21 .1% initial moisture content for drying temperatures of 50" C to 80" C.

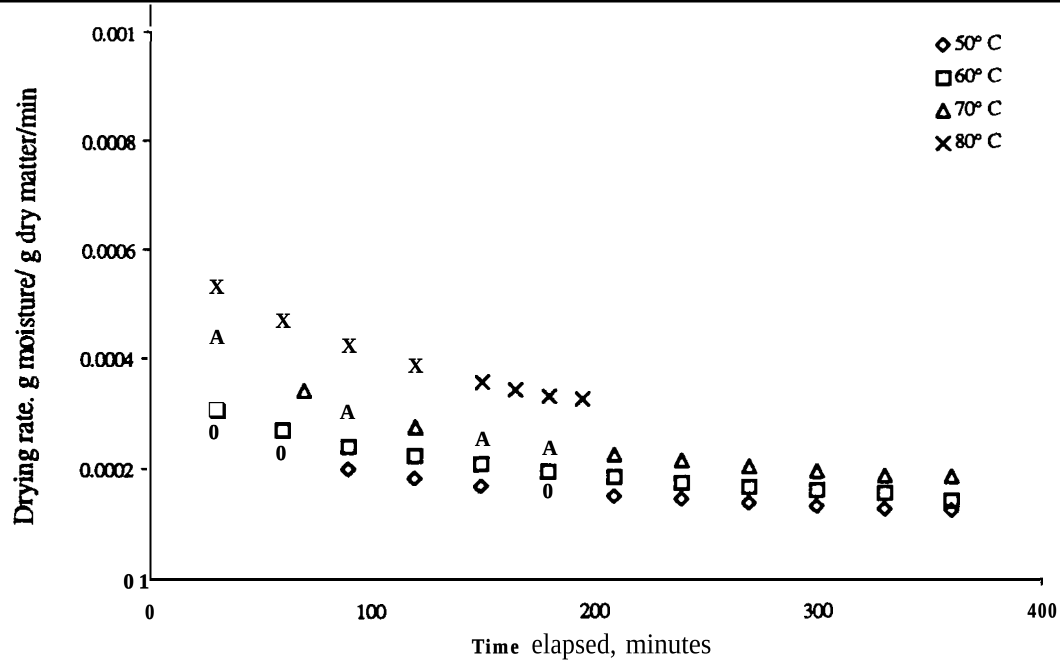

Fig. 5 Drying characteristics of field peas at initial moisture content 13.4 % w.b. for drying air temperatures 50° C to 80 ° C.

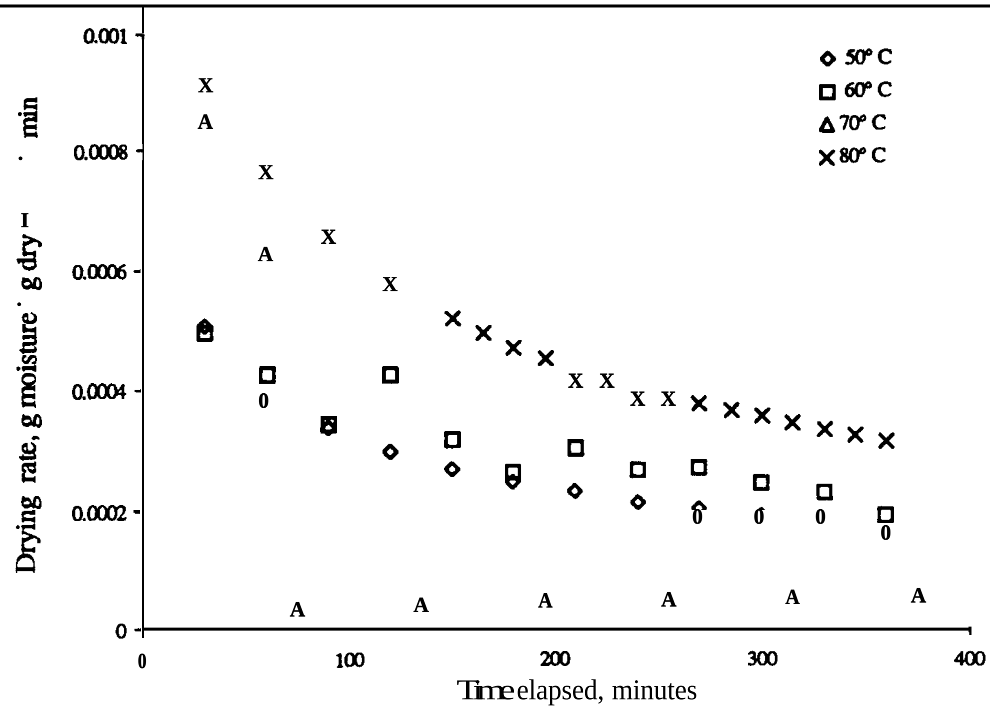

Fig.6 Drying characteristics of field peas at initial moisture content of 18.4 % w.b. for drying air temperahues of 50” C to 80” C

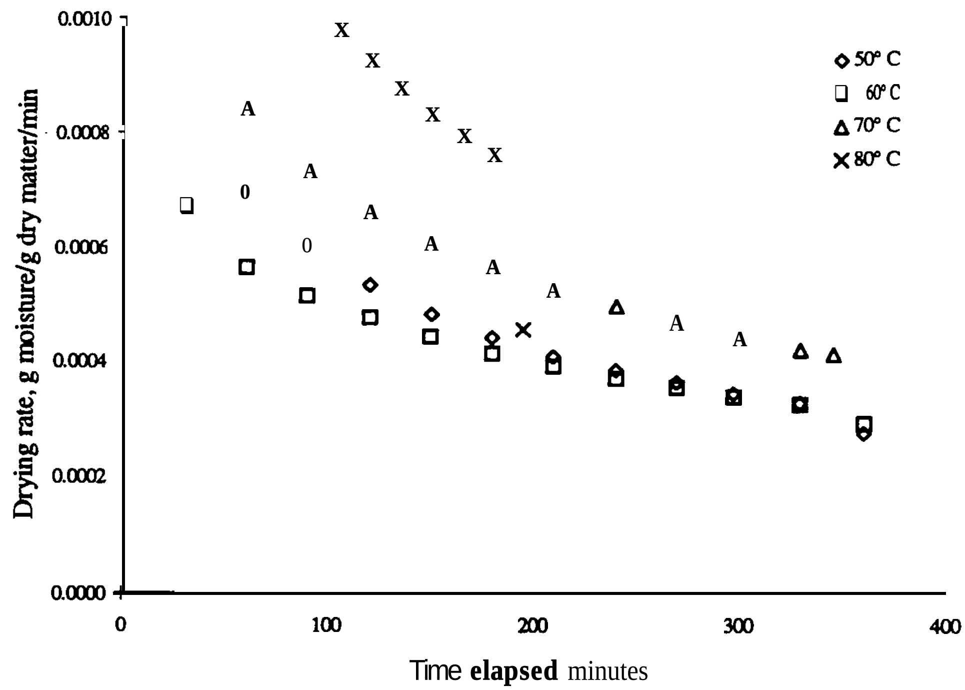

Fig. 7 Drying characteristics of field peas for initial moisture content of 21.1 % w.b. for drying air temperatures of 50” C to 80” C

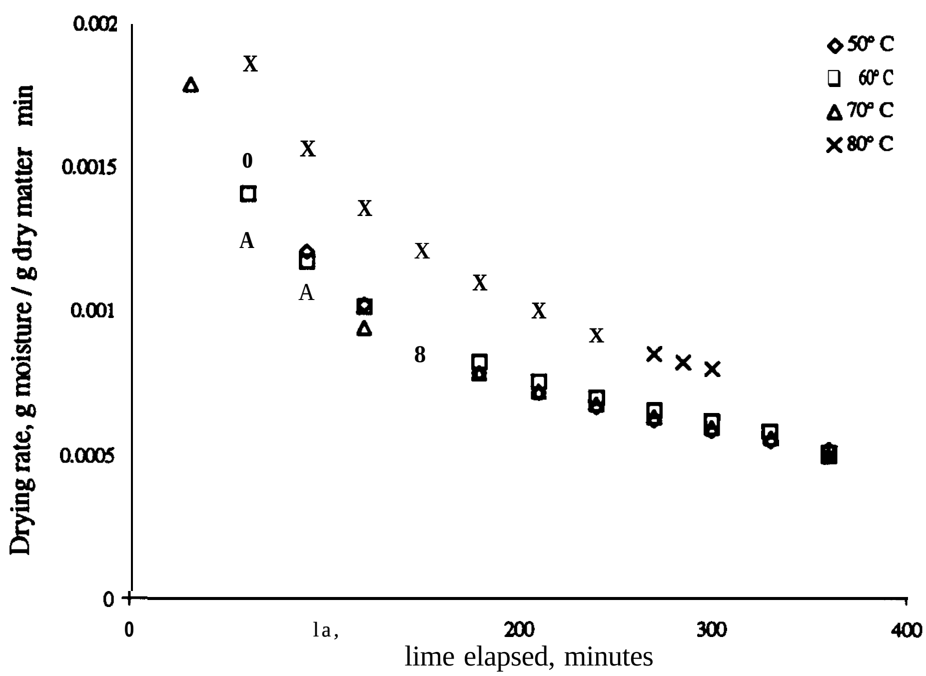

Fig. 8 Drying characteristics of field peas at initial moisture content of 24.7 % w.b. for drying air temperatures of 50” C to 80” C