

Dedication

To my father, mother

and

The rest of my family

with

Love and respect

Acknowledgement

Thanks to Allah for granting me strength, courage and good health throughout the course.

I wish to express my deepest appreciation and sincere gratitude to my supervisor Dr. El Nougomi Abdel-Gadir, for his close supervision and guidance throughout this study.

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Abstract

Experiments of onion slices solar drying in thin layer were conducted in Shambat. The objectives of the study were testing the performance of a natural convective solar dryer, determination of the drying characteristics of onion slices, simulation of the drying process of onion slices.

Fresh onion were brought from a central market for carrying out the drying trials. A data logger with thermocouples were used for recording temperature at intervals of one hour at inlet of the solar collector, inside absorber out let of the solar collector and ambient air.

Two hygrometers were used to record air relative humidities at intervals of one hour at inlet of the solar collector and out let of the solar collector. The drying process of onion was carried out for three successive days interrupted by two overnights.

Results indicate that, the solar dryer heated the drying air satisfactorily and this was depicted by the maximum attainable temperature difference between inside absorber and ambient temperature which was 38°C and the maximum attainable relative humidity difference between inlet and out let of the solar collector air relative humidities which was 20%.

Onion drying took place in the falling rate period i.e onion initial moisture content was less than the critical moisture content. The effective drying process for onion slices occurred in the first day while equilibrium state was attained during the second and third days of the drying process.

Two drying models namely, Lewis and Page, were used as a tester to simulate onion slices drying process consequently two mathematical models were written in turbo Pascal for window.

Results showed that, the two tested drying models predicted onion slices drying moisture contents accurately, however page model gave close agreement between measured and predicted data for validating the two drying models tested. Statistical analysis showed that, average model error (AME) average absolute difference (AAD) and standard error of estimate (SEE), were 0.120, 0.230 and 0.250, respectively for Lewis model while for Page model, the parameters are 0.112, 0.130 and 0.150, respectively.

خلاصة الاطروحة

اجريت تجارب لتجفيف شرائح البصل في طبقة رقيقة في شمبات أهداف الدراسة هي اختبار الاداء لمجففة شمسية تعمل بالحمل الطبيعي، تحديد خواص التجفيف لشرائح البصل، ومحاكاة عملية تجفيف شرائح البصل.

بصل طازج تم احضاره من السوق المركزي لاجراء تجارب التجفيف مسجل بيانات ومزدوجات حرارية تم استخدامها لتسجيل درجات الحرارة علي فترات زمنية قدرها ساعة واحدة عند مدخل المجمع الشمسي داخل الماص، مخرج الشمسي والهواء المحيط (الجوي).

جهازان لقياس الرطوبة النسبية للهواء تم استخدامها لقياس الرطوبة النسبية عند مدخل المجمع الشمسي، مخرج المجمع الشمسي، عملية تجفيف شرائح البصل اجريت خلال ثلاثة ايام متتالية فصلتها ليلتان. اوضحت النتائج ان المجففة الشمسية سخنت هواء التسخين بصورة مرضية هذا اتضح من فرق درجة الحرارة الاعلى والمتحصل عليه بين داخل الماص والهواء المحيط والذي بلغ 38°C وايضا فرق الرطوبة النسبية الاعلى والمتحصل عليه بين مدخل ومخرج المجمع الشمسي والذي بلغ 20%.

تجفيف البصل حدث في فترة المعدل الساقط وهذا يعني ان المستوي الرطوبي الابتدائي للبصل اقل من المحتوى الرطوبي الحرج. عملية التجفيف الفعلية لشرائح البصل حدثت في اليوم الاول بينما حدثت حالة اتزان خلال اليومين الثاني والثالث لعملية التجفيف. انموذجي تجفيف يسمينا لويس (Lewis) وبيج (Page) تم اختيارهما لمحاكاة عملية تجفيف شرائح البصل وفقاً لنموذجين رياضيين تمت كتابتهما في لغة تربو باسكال (Turbo Pascal) للنوافذ. اوضحت النتائج ان الانموذجين الذين تم اختيارهما عملاً علي تقدير محتويات الرطوبة لشرائح البصل بدقة لكن نموذج بيج (Page) اعطى اتفاق مقرب بين محتويات الرطوبة المقاسة والمقدرة.

لمضاهاة انموذجي التجفيف المختبرين اوضح التحليل الاحصائي ان خطأ النموذج المتوسط (AME)، الفرق المطلق المتوسط (AAD) وتقدير الخطأ القياسي (SEE) هي 0.250، 0.230 ، 0.120 علي التوالي لنموذج لويس بينما لانموذج بيج المعاملات هي 0.112، 0.130، 0.150 علي التوالي.