UNIVERSITI TEKNOLOGI MARA

THE EFFECTS OF LOW TEMPERATURE HEATED AIR DRYING ON JACKFRUIT, DURIAN AND CHEMPEDAK

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ABSTRACT

The main objective of this study is to investigate the effects of low temperature heated air drying (LTHAD) as a potential means for drying durian, jackfruit and chempedak slices for improved longevity and qualities such as colour and texture. In addition, quality characteristics including appearance and colour of three different methods, LTHAD, freeze- and hot air drying were analyzed. Colour of the dried fruits were measured by using a Minolta Chroma Meters CR-300 in terms of Hunter L*, a* and b* values while appearance (images) of samples were taken using Nikon Coolpix S510 digital camera. Drying kinetics obtained from LTHAD was investigated. The experimental works were carried out in a laboratory scale oven, freeze and low temperature heated air dryer. Three different temperatures were chosen for each type of drying methods. For LTHAD, the temperatures were 35°C, 40°C & 45°C, for hot-air, 80°C, 90°C & 100°C and -20°C, -30°C & -40°C for freeze drying. The fruits slices were dried for 24h for each drying methods at a constant air velocity of 2.0m/s. The results showed temperature had pronounced effects on quality of dried fruits. Drying at lower temperatures produced dried fruits of higher quality than hot air drying. Colour and appearance of dried fruits were acceptable at temperature 35°C. Results indicated that drying took place in the falling rate period. Eight thin layer drying models, namely, Lewis, Page, Modified Page, Henderson and Pabis, Midili and Kucuk, Logarithmic, Two Term and Verma et al. were fitted to drying data. Midili and Kucuk model was found to satisfactorily describe the LTHAD drying curves of jackfruit, durian and chempedak. The effective moisture diffusivity values varied from 7.5991×10^{-8} to 2.0834×10^{-7} m^2/s for jackfruit, 1.5401×10^{-8} to 2.3203×10^{-8} m^2/s for durian and 9.4355×10^{-8} to $2.3494 \times 10^{-7} m^2/s$ for chempedak. Calculated values of effective diffusivity showed Arrhenius-type temperature dependence. The activation energy values were 82.28kJ/mol for jackfruit, 33.35kJ/mol for durian and 74.16kJ/mol for chempedak respectively. Based on the results and analysis, LTHAD offers economical and effective alternative method of drying as compared to hot air drying. Freeze drying produces the highest aesthetic quality of dried fruit, but LTHAD produces good quality of dried fruit in a more economical manner, better suited for less developed nations. As a conclusion, LTHAD may offer an alternative means for drying fruit, but further work should be performed to investigate the effects of wider range of temperatures on the quality and consistency of the method with respect to the drying kinetics.

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CHAPTER 1

INTRODUCTION

This chapter provides the background and rationale of this study. It also discusses the objectives and significance reason that led to this research.

1.1 Background

1.1.1 Importance of fruits

Fruits are plant products with aromatic flavour that are naturally sweet or normally sweetened before eating (Jayaraman & Gupta, 1995). Fruits are the natural staple food of human. In spite of giving flavour and selection to human diet, it contains significant amounts of vital nutrients in a balanced proportion. Fruits supply minerals, vitamins and enzymes. It is easily digested and exercises a cleansing effect on the blood and the digestive tract. Person subsisting on this natural diet will have the benefit of healthy live. In addition, the illness caused by the intake of unnatural foods can be efficiently treated by fruits. Fresh and dried fruits are therefore not only a good food but also a good medicine (Bakhru, 2007).

Fruits have gained commercial significance and their development on a commercial scale has turn into an important sector of the agricultural industry. Recent advances in agricultural technology have enlarged the world production of fruits. As a result, a larger proportion of several main commodities are being handled, transported and marketed all over the world than before. Production and consumption of processed