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# Experimental Research of Drying Red Chili by Two Methods: Solar Drying and Low - Temperature System Drying

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**Abstract**

The objective of this research was to experiment of solar drying and Low-Temperature system drying (45-50%RH, 27-30°C) for drying red chili. Solar drying during daytime (greenhouse dryer) and during at night using climate control system to coordinate with air conditioner in drying. The Low-Temperature system consists the humidity control unit (ultrasonic), air-conditioner, temperature and relative humidity sensor, heating coil and microcontroller unit. For Low-Temperature drying process, climate control system controls the compressor in the air conditioner by turn on-off to control the temperature and relative humidity in the chamber. The dehumidification process by controlling the temperature of the surface evaporator coil is decreased to the dew point temperature, making water vapor in the air condensed to be water drops. The result of solar drying and Low-Temperature system takes 52h to reduce the moisture content of about 74% to 13.5% (w.b). For temperature and relative humidity of the solar drying at 50 °C and 36%RH by average, in during daylight and at night with Low-temperature drying system by the climate control system coordinate with air conditioning system in moisture reduction at 27-30°C and relative humidity at 45-50%RH for drying chili in the night. These processes were found to have average temperatures and relative humidity for drying at 27.55°C, 47.37% RH., moisture condensation rate and specific energy consumption at 2.16 $kg_{water}$/h and 0.75 MJ/kg.


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*Keywords: Climate control system; Low-temperature system; solar drying; red chili,*

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## 1. Introduction

Thailand is located in the tropical climate zone. The annual average temperature is 27C and the relative humidity is in a range of 40-80% RH.[1] The high humidity in the air affects on dried chili products, which the fungi easily takes place causing these products to have low quality. Chili is a main ingredient in cooking, as it has high nutritional value. For red chili, it was found to be very nutritious, with high vitamin C (175mg /100g), calcium (15mg/100g), fiber (4.8%), protein (2.8%), iron (1.8mg/100g), ash (0.9 mg /100g) and lipids (0.7mg/100g) [2]. It is also source of nutrients in the human diet. In Thailand, red chili is usually dried directly under the sun. Direct solar drying requires an area with a large, open space and long drying times. It is highly dependent on the availability of sunshine and is susceptible to contamination of insect, pests, fungi, microorganisms and dust. Most agricultural products require drying process in an effort to preserve the quality of the final product. The drying process requires high heat to vaporize in the material, but the use of high heat also affects in a loss of color, aroma and vitamins in products.[3] Commonly, heat pump and solar dryers have operated in the range 35-70 °C [4]-[7]. It is a high temperature. However, solar drying offers are a cheap method, but have two main weaknesses. It is the drying discontinuously and dependent on weather condition and location. During nighttime, ambient temperature decreases, the relative humidity increases. In some cases, dried chili absorbs moisture in the air until the moisture of the dried chili is balanced with relative humidity in the air. There have been reported that the relative humidity level in the air can affect the growth of fungi. The research of Anthony V Arundel el at was found that the fungi in the air grew well at relative humidity higher than 60% RH, as shown in Fig. 1.

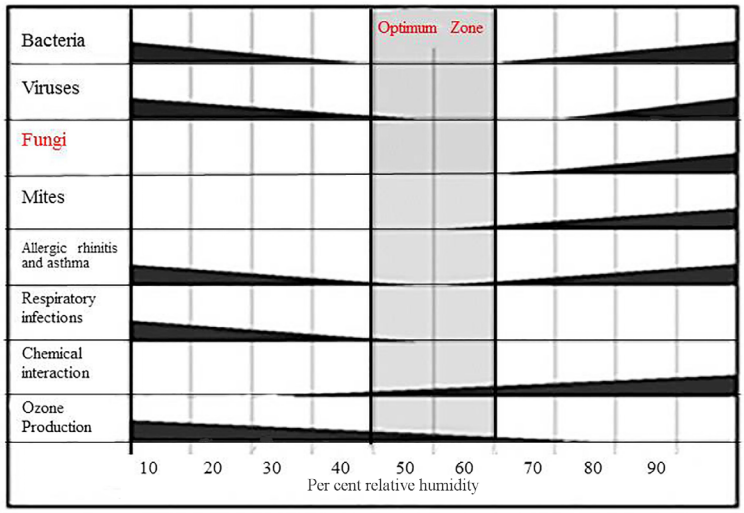


Fig.1 Range of the relative humidity that the fungi and bacteria can grow [8]

The fungi and bacteria cannot grow when the humidity is in the range of 40 -60%RH. Therefore, the relative humidity must be kept in this range for food to be safe from fungi [8]. Under these conditions, a new method for drying chilies, which low-temperature drying s similar to heated air drying but does not involve heat. For this research, dried chilies were sun dried during daytime and night time they were dried with low temperature system until the moisture content in chili was 13.50wb. The low temperature system is to reduce the relative humidity in the air by controlling the temperature at the surface of the cooling coil of air conditioning to below the dew point temperature, air is condensed into water drop. The relative humidity and temperature of the air is low. Dehumidification is carried out by applying an air conditioning system, working with a climate control unit to control temperature and relative humidity at 27-30°C and 45-50% RH, [9] respectively, for drying of red chili during the night. The aim of this research is to evaluate the performance and power consumption of solar drying intergraded with low-temperature drying system in controlling temperature of 27-30ºC and relative humidity of 45-50 %RH.