

CHAPTER 1

INTRODUCTION

1.1 Principles, rationale and hypothesis

The major factor affecting quality and price of dried longan is moisture content. The moisture content of dried longan must not exceed 13.5% Wb of whole fruit or 17.0% Wb of aril (National Bureau of Agricultural Commodity and Food Standard, 2005). Presently, there is no specific instrument for moisture content measurement in dried longan. The moisture content can be measured either directly or indirectly. The standard direct measurement includes the application of hot air oven which consumes a great deal of time. Nelson (1982) study compared to the indirect counterpart that employs an electrical technique based on two electrical properties, namely, resistance and capacitance. Although this method is quick and accurate, the measurement is indirect and the accuracies are limited to 7 - 17% Wb for electrical resistance and 6 - 21% Wb for capacitance. The measurement of capacitance or dielectric properties has gained importance because it involves a non-destructive monitoring of specific properties of materials which undergo physical or chemical changes. There are several techniques to determine the dielectric properties of agri-food materials. Dielectric properties were utilized to quantitate moisture content in grain (Venkatesh and Ragkavan, 2004). Two commonly used methods in order to acquire signals for determination electrical properties base on frequency wave and signal pass wires. The factors which affect electrical properties of the frequency wave are moisture content, electrical frequency, density and temperature (Nuri, 1992).

The electrical capacitance technique is another popular method for moisture content determination (Ryynanen, 1995). This method relies on the dielectric property of material between the plates of condensers. The dielectric property of material affects the capacitance of condensers. The moisture content of material, in turn, affects the dielectric constant. If the moisture content of material is at high level, the dielectric constant will elevate. The same is also applied for moisture content at low

level as both properties are directly proportional to each other. Dielectric constant value of water at 20°C is unity.

In comparison with the frequency wave method of capacitance, the signal pass wires are more popular for determining the moisture content. The former method is used in the examination of other quantities such as density and sweetness.

At the present, dried longan producers can only estimate the moisture content in their products by the observation of skin surface, aril and seed characteristics which relied heavily on experiences. The development of rapid and accurate method for moisture content detection of dried longan based on electrical properties will provide an alternative means for the producers and farmers. They can use this method for moisture content measurement with relative ease while maintaining a good quality product. The method may be universally standardized in the future which leads to fair trade for all parties. The designed equipment can be used repeatedly for a long period of time.

1.2 Research objective

The objective of this research was to develop a practical method for quick and accurate measurement of moisture content of dried longan aril only by using electrical capacitance and dielectric constant.

1.3 Research scope

- This research proposed an original method to determine the moisture content of dried longan aril. The measurement procedure was obtained based on five components namely a direct-current power supply circuit, an oscillator circuit, a frequency divider circuit, a computation unit and an LCD display circuit.

- Five different moisture contents of 10, 14, 18, 22, and 25 % Wb and three bulk densities of 1,300, 1,450, and 1,600 kg/m³ were applied which accounted for $5 \times 3 = 15$ treatments.

- One hundred replicates of dried longan aril were tested in each treatment with the total number of investigated samples of 1,500.

1.4 Usefulness of the research

The relationship between the moisture content of dried longan aril and the corresponding electrical capacitance and dielectric constant was elucidated in the current study. The result was then applied to develop a practical method for accurate measurement of moisture content in dried longan aril so that the quality of dried longan can be assessed conveniently and easily. It was hoped that the invented instrument would eventually assist in the alleviation of dried longan unfair trade.

1.5 Research locations

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