OP-09

THE VERIFICATION OF MEASUREMENT DEVICE FOR DRY RUBBER CONTENT IN LATEX BY PARALLEL PLATE CAPACITOR TECHNIQUE

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ABSTRACT

In this research was to study a parallel plate capacitor was used to measure the dry rubber content of concentrated natural latex in term of capacitor. By pouring water latex into the experimental 3 sets of sizes 19×10×1 cm^3 at the water percentage to blend with natural rubber latex are 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50 by volume, respectively. Change in dielectric constant of natural rubber latex was investigated as a function of dry rubber content (%DRC). Results showed that the dry rubber content in the range of 13-39%, the dielectric constant in the range of 1.348 to 4.365. The linear relationship between dry rubber content and dielectric constant (k) was obtained with linear regression equation of the multimeter are y = -0.1098x+ 5.7394, y =-0.0886 x+4.7358 and y = -0.069x+4.2966. And the LRC meter are y = -0.1077x+5.5795, y = -0.1109x+5.9595 and y = -0.1133x+ 6.0455.

INTRODUCTION

Thailand has rubber plantations spread throughout the region. Especially in the 3 southern border provinces. Most of the farmers are small rubber growers. It is a family production. It is often sold as rubber latex rather than rubber sheet to save time. From the frequency sketching system, the number of days per week is very sharp.[1] The average yield per session. According to the percentage of dry rubber in the purchase. This results in high average cost per kilogram. The profits should be reduced. Due to the time of buying and selling rubber, the price of rubber latex. Dry rubber content (% DRC) is the most important method for checking dry rubber content. There are two main ways of checking the percentage of latex for rubber purchase (Chaisrichonlathan et al., 2011). By using a high-precision ISO 126: 1955 process, it takes about 16-24 hours to validate and calculate the density of the latex with a measuring instrument called Metrolac.[2-4] The error of dry rubber percentage was higher than 35 percent in Malaysia. And higher than 39 percent in Thailand.

Nowadays, when the method to determine the percentage of dry tires is still a problem. And the insecurity of the rubber farmers for a long time.[5] And the problem is going to continue in the future. Researchers and teams use theories of electrical dynamics. Study on the form and method of measuring the concentration of latex.[6-8] To design a device for measuring the concentration of latex by parallel plate capacitors. By testing the quality of the device, the capacitance relationship within the parallel plate capacitor Constant dielectric constant and% DRC in rubber latex as a guideline for the development of new knowledge to create an innovation in accurate measurement of rubber latex in rubber latex. More precise To help the rubber farmers to check their output. This will lead to the integration of farmers in the quality inspection of the yield. Fair pricing And to fix the defects of the product in the future.

EXPERIMENTAL

Research Objectives:

1. Study the form and method of measuring the concentration of latex.
2. Design of rubber latex cone measuring device by parallel plate capacitor (prototype)

3. Test the quality of the rubber latex cone by the parallel plate capacitor (prototype).

Method:

Sample

The rubber latex was obtained from rubber plantation farmers in Sateng Sub-district, Mueang District, Yala Province. Samples were collected after the rubber seedlings were harvested for about one hour in a 5 liter closed plastic bucket.

Research tools

Capacitor is a device that is used to charge and can discharge by bringing the two conductors are placed parallel to each other but not up to each other. Between the two conductors, insulated with dielectric may be ceramic air mica. Or other insulating material. The structure and symbol of the capacitor is shown in Figure 1.[10-11]

The capacitance is generated by the input of the electromotive force to the two terminals of the conductor point (number 1), causing the potential difference. And the electric field formed on the conductor is a plate. Resulting in higher storage capacity. It's called capacitance. Figure 2 capacitance is more or less dependent on three factors: the area of the conductor (A) of the conductor, ie, the plate. If the cross-sectional area is large, it can hold a lot of charge. If the cutting area is less, the charge is less. The distance between the two plates (d) is that if the plate is in a close position, the capacity is very large. If it is in a far position, capacity will be less. And dielectric constant (k), which represents the ability to generate magnetic force lines. When different materials are made to insulate between sheets. Each dielectric constant varies. So the different dielectric capacitors Even the same size. Capacity and voltage ratings may vary. Vacuum is the least efficient dielectric compared to other materials. The capacitance can be calculated from the equation as follows:

$$C = k\frac{A}{d} \qquad (1)$$

When C is the capacitor (F), k is the dielectric constant. A is the cutoff area of the plate conductor (m^2) and d is the distance between the plate (m).

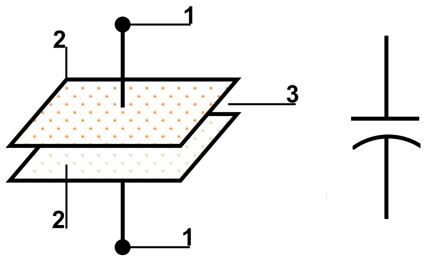

Figure 1 : Structure and Symbols of Capacitors (Number 1 is the point to circuit 2 is conductor plate and number 3 is insulation)

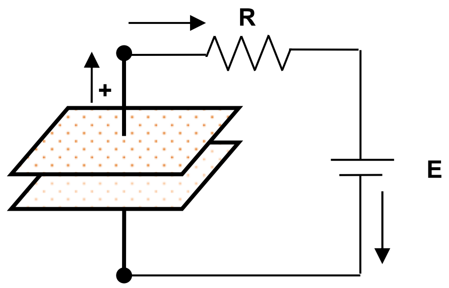

Figure 2: Electric capacity due to electric input

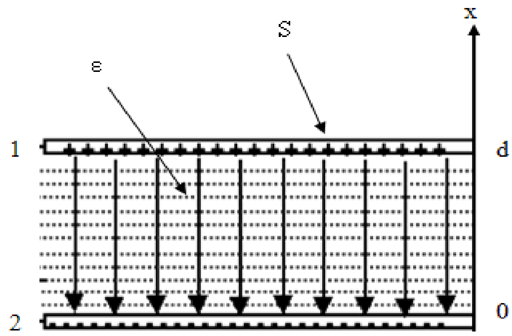

Figure 3: parallel plate capacitor

In the same way, the case of parallel plate capacitors consists of two flat plate capacitors. There is a space plate A and put away d to cut the electric margin. This makes the edge electric field unequal so that d is very small compared to the width of the parallel plate. Assume that the electric field between the parallel plates is uniform. And the gap between the conductor and the dielectric. Figure 3 shows the Gaussian law [12]. According to equation (2) is

$$E = \frac{\sigma}{\varepsilon} = \frac{Q}{\varepsilon A} \qquad (2)$$

When Q is the charge that accumulates on each parallel plate ($Q = \sigma A$), the potential difference between the parallel plates is obtained from the equation $\Delta V = Ed$ and from the equation $Q = C\Delta V$ or $C = \frac{Q}{\Delta V}$ the charge of this capacitor is

$$C = \frac{Q}{Ed} = \frac{\varepsilon A}{d} \qquad (3)$$

It is evident that the capacity is proportional to the area of the parallel plate. And dielectric condition and it is inversely proportional to the distance between the parallel plates. This shows that it depends on the geometry of the capacitor. If the gap between the parallel plates is not dielectric but as a vacuum the capacitance called C_0 the equation (3) is (4)

$$C_0 = \frac{\varepsilon_0 A}{d} \qquad (4)$$

Data collection: Dielectric constant measurement

1. Equipment for measuring the concentration of latex or Dry Rubber Content (% DRC) can be achieved by using a parallel-plate capacitor built with the following aluminum foil materials 3 sets of sizes $19 \times 10 \times 1\ cm^3$ figure 4
2. When the dielectric measuring device was built successfully. Then measure the capacitance with a multimeter and an LRC. In a dress that is not put rubber at pressure 1.5V figure 5.
3. Pour fresh latex into the test kit. Water content of 0, 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50 percent of latex was measured the capacitance by multimeter and a LRC at repeated pressure 1.5V. figure 6

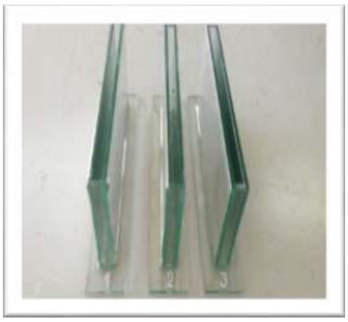

Figure 4: A parallel-plate capacitor built with the following aluminum foil materials

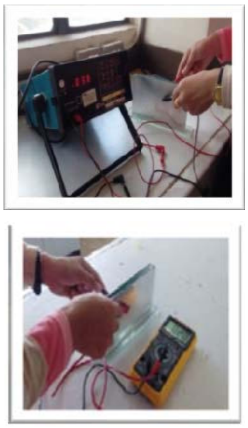

Figure 5: Then measure the capacitance with a multimeter and an LRC

Figure 6: Pour fresh latex into the test kit. Water content of latex

Figure 7: Determination of percentage of dried latex according to the standard method.

Determining of dry rubber content

Determining latex to the percentage of dry rubber content in latax. By standard method (Preeda Wanchai, Chonchai et al., 2011) by weighing 10.0 g. of latex. By add 20 ml. acetic acid, rubber sheet thickness of 2.0 mm and then bake in the oven at 70.0 deg C for 16-20 hours. As shown in Fig.7, calculate the percentage of dry rubber content is

$$\%\,DRC = \frac{d}{W} \times 100$$

The data obtained were then graphed to show the relationship of the dielectric constant within the capacitor parallel to the percentage of dry rubber content to be used as a reference for measuring the concentration of fresh latex.

RESULTS AND DISCUSSION

Experimental results and analysis The relationship between dielectric constant in latex and dry rubber content was found. Dielectric constant of latex at pressure The size of the frost Three sets of multimeters are in the range of 1.503-4.057, 1.391-3.530, 1.682-3.464, and three LRC measurements are in the range of 1.348-4.090, 1.631-4.341, 1.676-4.365. The dry rubber content of fresh rubber at 1.5 volts. The area of the aluminium foil is inversely proportional to the water percentage, that is, when the water content increases, the dry rubber content decreases. And the amount of dry rubber content inversely proportional to the dielectric constant, ie, when the amount of dry rubber increased. The dielectric constant decreases as well. It is consistent with the research conducted that the concentration of latex is in the range of 25-45% and is similar to the research report of researcher[13]. Given that the DRC% of latex is inversely proportional to the percentage of water, when the water percentage increases, the DRC% value decreases. [14]

CONCLUSION

A parallel plate capacitor was used to measure the dry rubber content of concentrated natural latex in term of capacitor. By pouring water latex into the experimental 3 sets of sizes 19×10×1 cm^3 at the water percentage to blend with natural rubber latex are 5, 10, 15, 20, 25, 30, 35, 40, 45 and 50 by volume, respectively. Change in dielectric constant of natural rubber latex was investigated as a function of dry rubber content (%DRC). Results showed that the dry rubber content in the range of 13-39%, the dielectric constant in the range of 1.348 to 4.365 in table 1 . The linear relationship between dry rubber content and dielectric constant (k) was obtained with linear regression equation of the multimeter are y = -0.1098x+ 5.7394, y = -0.0886x+4.7358 and y = -0.069x+4.2966 in Fig.8. And the LRC meter are y = -0.1077x+5.5795, y = -0.1109x+5.9595 and y = -0.1133x+ 6.0455 in Fig.9.

Table 1: Results of experiments to determine the relationship between dielectric constant and percentage of Dry rubber content in latex by parallel plate capacitor. From the multimeter and LRC.

Water content (%)	dielectric constant		%DRC
	multimeter	LRC	
0	1.525	1.552	29
5	1.635	1.851	37
10	1.851	2.055	34
15	2.139	2.312	31
20	2.278	2.614	29
25	2.528	2.901	26
30	2.693	3.151	21
35	2.953	3.492	19
40	3.162	3.789	16
45	3.510	3.964	14
50	3.684	4.265	13

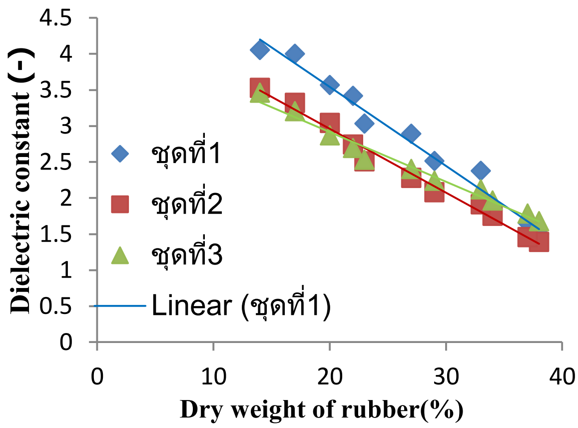

Figure 8: Relationship between dielectric constant in latex and dry rubber content of multimeter.

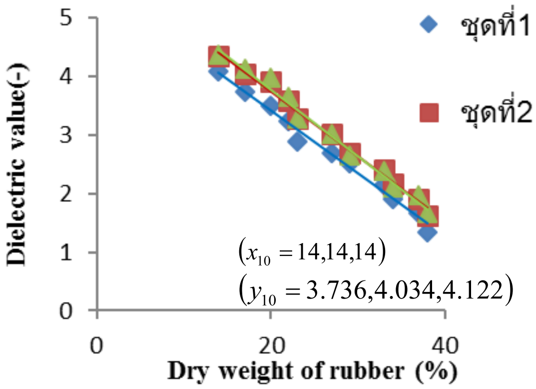

Figure 9: Figure 8: Relationship between dielectric constant in latex and dry rubber content of LRC

ACKNOWLEGMENT

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