Study on rapid measurement technic of dry rubber content in latex cup lump by electrical properties

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Abstract. Dry rubber content meter is substantial tool for Impartial trade on rubber cup lump. Department of Agriculture researchers proposed rapid measurement technic of dry rubber content in latex cup lumps by their electrical properties. Two probe types needle and roller were designed, in the first phase, constructed, installed and tested. Needle type probe of 25 mm. in length and 5 mm. apart was selected in measuring electrical properties of cup lump samples as its penetration depth is half of the thickness. Two cylindrical rollers probe of 220 mm. in length and 101.6 mm. (4 inches) in diameter powered by 2 HP gear motor were designed, constructed, installed and tested. Rubber cup lump samples were each statistical divided into 9 regularly measuring parts in needle type probe. Rubber cup lump samples in rollers type probe were typically enforced to pass through 1-inch gap between two rollers. Irregular size sample of more than 76.2 mm. (3 inches) thickness of rubber cup were sliced before measuring into 2 equal thickness pieces. Electrical properties of samples were acquired by standard electrical measuring instruments and percentage of dry rubber content were determined by standard oven method for all sample segments. As the results of this study, rubber content percentage of cup lump was correlated with electrical capacitance than resistance. Electrical capacity value of the latex cup lump from needle-type and two roller-type probes were inversely correlated with the percentage of dry rubber content within the range of 0 – 75 nF and 0 – 380 nF and coefficient of determinations were 0.90 and 0.97, respectively. These initiate features will be utilized in designing of percentage of dry rubber content prototype meter by electrical property values in the future. Percentage of dry rubber content from DRC method of lump from fresh latex and conventional cup lump by oven method was significantly correlate. Electrical properties of latex cup lump produced in the laboratory and farmers are also significantly consistent.

1. Introduction
Latex cup lumps are products from the upstream rubber industry. All latex cup crumbs are processed into crepe rubber by partially dehydrating. Crepe rubber will be further processed into 2 types such as compound and block rubbers. Sixty-billion-baht value or 82.8 percent was export market share of Thailand's block rubber industry [1].

Dry Rubber Content (DRC) of latex cup lump is necessary consistent to control rubber quality in each industry. But currently, trading of latex cup lump relies mainly on subjective domain. Visual assessment was used for considering the latex cup lump characteristics. There are no scientifically clear gauge tools. The latex cup lump value was deducted according to the humidity depend on considering of assessor, which bias in the quality evaluation was not able to avoid [2].

Rubber farmers attained lower selling price of latex cup lumps due to unjust subjective domain trading. Urgent request ensued on measure tool for percentage of dry rubber content in the latex cup lumps that provides accurate measurement results, fast and easy to use. Department of Agricultural proposed rapid measuring dry rubber content in latex cup lumps technique by electrical properties.

2. Experimental
2.1 Experimentation on Probe types
Two types of probes, needle and two rollers were designed and built. The needle probe was 25 mm. in length of 25 mm. and 5 mm. in distance between two needles that is approximately half the thickness of the latex cup lump. Two roller probes, each roller was 220 mm. in length and 101.6 mm. (4 inches) in diameter powered by 2 HP gear motor which determined from properties of pressure on the latex cup lumps. Latex cup lumps produced by farmers were used to be samples. In needle probe experiment, sample of rubber lump was divided into 9 parts of measuring (Figure 1). In two roller probe experiment, distance between the surfaces of two rollers was set at 25.4 mm. (1 inch) for normal thickness cup lumps (Figure 2). Sample that was thicker than 76.2 mm. (3 inches) would be cut into 2 by thickness. Measure electrical properties was determined by DT-9205A. standard electrical meter. The percentage of dry rubber contents were analyzed by drying of small pieces method at the middle position of all segments.

Figure 1. Investigation of electrical properties using needle-type probe.

Figure 2. Investigation of electrical properties using two roller-type probe.

2.2 Comparative experiment for determination of dry rubber content by DRC measurement in fresh latex method and drying of small pieces method
Fresh latexes were collected by the formulation of one latex cup lump per rubber plant was collected in plastic bottle. Dry rubber content percentage were analyzed by DRC method in the fresh latexes (Figure 3) and latex cup lumps were produced in laboratory (Figure 4). Latex cup lumps sample were cut into small pieces to find the dry rubber content percentage by drying of small pieces method. The percentage of dry rubber content was compared by DRC measurement in fresh latex method and drying of small pieces method.

3. Results and discussion
3.1 Probe types Experimentation results
Rubber content percentage of cup lump was correlated with electrical capacitance than resistance. Electrical capacity value of the latex cup lump from needle-type and two roller-type probes were inversely correlated with the percentage of dry rubber content within the range of 0 – 75 nF and 0 – 380 nF and coefficient of determinations were 0.90 and 0.97, respectively. Detection limit of needle-type and two roller-type probes for the percentage of dry rubber content (%DRC) measurement were 55 – 84 and 54 – 76, respectively. These initiate features will be utilized in designing of percentage of dry rubber content prototype meter by electrical property values in the future.
3.2 Comparative experiment result for determination of dry rubber content by DRC measurement in fresh latex method and drying method.

Result showed that the analytical methods for the percentage of dry rubber content by DRC measurement in the fresh latex method was high linearly correlated with drying of small rubber piece method (Figure 7).
4. Conclusions
Electrical capacitance properties will be utilized in designing of percentage of dry rubber content prototype meter by electrical property values in the future. Electrical capacity value of latex cup lump when using a needle probe and two roller probe were inversely correlated with the percentage of dry rubber content. For convenience of artificialing prototype meter experiment, drying of small pieces method can be used instead of the percentage of dry rubber content by DRC measurement in fresh latex method.

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