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DESIGN AND DEVELOPMENT OF COPRA MOISTURE METER

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ABSTRACT

For safe storage copra its moisture content should be less than 6 per cent. At about 10 per cent level serious mould damage occurs and the product is more subject to attack of insect pests. For a rapid and accurate estimation of moisture content, an electronic moisture meter was developed on the principle of electric conductivity. The instrument is calibrated against standard air oven method. It can read moisture content from 5% to 40%. The instrument is handy and useful to copra processors.

INTRODUCTION

In the field, moisture content of copra is often estimated subjectively by observation of the texture, appearance or by observing how fast the copra piece picks up flames.

A direct method of determining moisture content is to place weighed samples in an oven for a few hours till the water is completely evaporated. The sample is again weighed from which the original moisture content of the sample can be calculated (air oven method). This is standard method of determining the moisture content and is used as a basis for calibrating the moisture meters. However, the oven method is too slow, costly and cannot be adopted by farmers.

Indirect methods have in general replaced direct methods because of their rapidity of measurement, easiness of operation and less cost involvement. Indirect methods measure a property of the product viz., the electrical conductivity, deelectric property which depends on the moisture content. This paper deals with the design and development of a copra moisture meter based on the principle of electrical conductivity.

MATERIALS AND METHODS

Design details

The copra Moisture Meter consists of a square wave oscillator, sensor, rectifier bridge and a 100 μA out put meter (Fig. 1). The instrument requires a 6 V stable supply which is derived from a 9 V Eveready 216 battery or through an Eliminator. The sensor consists of a pair of steel rods of 0.2 cm diameter fixed 0.6 cm apart. The sensor is fabricated in such a way that it can probe coconut kernel to a depth of 0.8 cm only. This value is selected because the average thickness of copra is about 0.8 cm and the sensor

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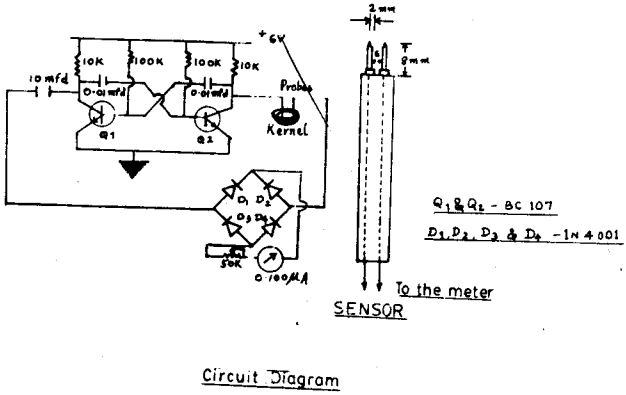

Fig. 1. Copra moisture meter

must be probed fully into the kernel (Fig.1).

When the sensor is pressed into the kernel the a.c. signal generated by the oscillator is passed through the copra and after rectification read in the 0-100 UA ammeter. As the sensor rods are kept separated by 0.6 cm, the current measured on the meter gives the conductivity/moisture content of 0.6 × 0.2 × 0.8 cm of copra (approximately). So the sensors are to be probed at different points in the same sample to have the average reading. This is often very much necessary as the drying of copra may not be uniform.

Calibration of the meter:

The moisture meter is calibrated against standard air oven method. Samples were collected at different stages of drying and their conductivity in UA is noted in the moisture meter. The moisture content of the same samples were also determined by oven method. A graph was plotted showing the per cent moisture content on wet basis estimated by oven method and the corresponding UA reading read on the moisture meter (Fig. 2). The readings were statistically analysed and suitable equation formulated. As the scatter of the points in the graph showed steep increase beyond 12%

Table I. *Equations used for calibration of moisture meter*

Type of equation	No. of samples used	Equation	r^2 value	Limits in variables
Y = a + b X	53	Y = 2.932 + 0.1482 X	.82	14 X 65
	40	Y = –72.29 + 1.2509X	.83	70 X 90

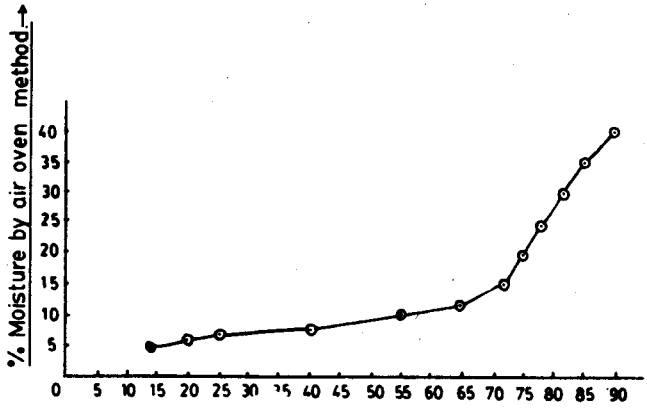

Fig. 2. % Moisture-meter reading in Micro amps

moisture, two separate straigth lines are fitted between the limits (X = 14 to X = 65) and (X = 70 to X = 90). The equations are given in Table I. The observed and predicted values of percent moisture corresponding to UA readings (X) and the deviation from the standard air oven readings are given in Table II. The instrument was calibrated from 5% to 40% moisture content.

RESULTS AND DISCUSSIONS

From Table II it can be seen that the per cent error is nil at 5% M.C and 0.11 at 6% M.C increasing upto 0.58. So the accuracy is more than 94% in the lower moisture level observations which is actually required by the copra processors and farmers.

The moisture estimation by this instrument is non-destructive as the samples of copra do not get damaged by the introduction of sensor in to the kernel. Unlike other moisture meters the operation is simple and rapid. The instrument can be fabricated very easily and the cost per unit will be less than Rs. 450.

Table II. *Observed and predicted moisture values of copra*

Moisture Meter Reading μA	Observed Moisture by air oven Method	Predicted Moisture values %	Deviation from observed reading
14	5.00	5.00	Nil
20	6.00	5.89	0.11
25	7.00	6.64	0.36
40	8.00	8.26	0.26
55	10.00	10,58	0.58
65	12	12.56	0.56
72	15	17.77	2.77
75	20	21.52	2.52
78	25	25.27	0.27
82	30	30.28	0.28
85	35	34.03	0.97
88	38	37.78	0.23
90	40	40.28	0.28

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