

SOLAR PROCESSING MONITOR

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An electronic equipment developed for monitoring the parameters relevant to solar drying of fish, namely, relative humidity, wind velocity, solar radiation, water evaporation, air temperature, weight loss and moisture is described briefly in the paper. The special features and advantages of the equipment are remote operated sensors enabling centralised monitoring, integration of wind and solar energy indicating their respective total values over long duration, recording facility and flexibility to accommodate any number of the parameters as required for specific programmes.

Introduction

Much studies have been conducted on the influence of parameters such as air temperature, relative humidity and air velocity on the materials undergoing drying by Van Arsdel and Copley (1963), Legendre (1955), Prabhu et al (1963) and Balachandran (1969). Curran and Trim (1982) has recorded the solar radiation, wind speed, ambient temperature, relative humidity and temperature within the dryers at hourly intervals for comparative study of solar driers. The instruments already developed for measuring the drying parameters mostly are permanently installed types without remote measurement facility. Hence in such cases every observation has to be made at very close range of the instrument.

The equipment reported here is designed to monitor the parameters in an integrated manner at a centralised place enabling the related studies more effective and easy.

Materials and Methods

The instrument is a remote operated wire telemetry system with eleven different sensors fitted at different locations along with a centralised display unit where the signals are processed and the corresponding data displayed. Fig.1 shows the block diagram of the instrument. Each sensor is connected to the instrument by cable and automatically selected by the multiplexer of the instrument at a predetermined sequential interval. The signals from the transducers are processed in different signal processors and fed to a digital panel meter which is calibrated for each of the parameter to be measured. Calibrated output is also provided for recording the data continuously in a strip chart recorder.

Transducers

The brief details of the transducers specially developed for the purpose are given below:

Solar radiation: Opto-electric pick up giving output proportional to the intensity of incident solar radiation. (Range : 0 to 1400 watts/m²/sec).

Temperature: Semi conductor giving output in relation to temperature variation (Range: 0 to +80°C, ±0.1°C)

Water evaporation: Electro inductive pick up based on floatation principle giving output depending on water level variation of a known volume of water undergoing evaporation (Range: 0 to 40 ± 0.1 mm)

Wind velocity: Opto-electric pick up producing electric pulses proportional to the velocity of air (Range: 0 to 100 ± 1 KMPH)

Fish moisture: Impedance variation of fish at different moisture levels is picked up by the probe (Range: 0 to 50 ± 1%).

Signal procesors

The analogue and digital signals received from the transducers conditioned to 0 - 5 V d.c. and processed for presentation in their respective units.

Data display

Data regarding all the parameters are displayed in a 3.5 digit LED panel meter and also simultaneously recorded in an external strip chart recorder. A set of LED indicators provided in the front panel against which names of sensors are inscribed, help to identify the data displayed. An audio alarm produced by the instrument, whenever it switches from one transducer to another indicate the trouble-free operation of the instrument.

Integrators

The analogous signals of solar radiation and wind velocity are integrated to estimate their total values for fixed durations. These values are expressed as total solar energy in watts/m² and total volume displacement of air in m³ per sq m area.

Results and Discussion

Unlike conventional instruments the sensors are remote operated and hence the display meter can be installed at a central place away from the dryer or the sensors can be spread over a wide area distributed in different driers or places. The transducers are standardised to give uniform signal output throughout the measuring range for each parameter. The transducer being the most important part, special care has been taken in its design to suit to the hostile environmental conditions existing in the dryers exposed to solar radiation and wind. This has reduced the accuracy of weight sensor to about 5 g in the range 1500 g. Though moisture measurements have 0.1% resolution, its absolute value is subjected to errors due to different salt contents and wide temperature variations.

As shown in Fig.2 the equipment has been designed quite compact enclosing all electronic parts in a single unit.

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