MONITORING THE MOISTURE CHANGES IN THE WOOD

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Abstract:
Various studies have been conducted on soil, concrete and other hygroscopic materials to understand their behavior by using electrical resistance method. Wood is an extremely complex organic material with characteristics of porosity, hygroscopicity and anisotropy. The objective of this study was to determine the effect of moisture and other experimental factors on the total electrical resistance of wood. While formulating the determinations for this study, the effect of, moisture content, direction of flow of current, and spacing between electrodes have been considered.

1. INTRODUCTION: Wood is one of the Earth's most versatile and probably the most familiar natural raw material. Until this century the application of wood into countless forms of tools, shelter, transportation, decoration and furniture has been noteworthy as well as remarkable. (Kramer 2006). Due to the ever-increasing demand of wood, wood processing industries are under increasing economic pressure to maximize its worth, hence estimating the quality of wood for any application has now become critical to quantify its productive value (Wang et al 2007a)

Several technologies have been developed such as non-destructive testing technologies (NDT) to assess the intrinsic properties of wood using ground penetrating radar to assess plant rooting distribution and growth. Development and use of such technologies not only lead to great profitability for the wooden industry but also for making better environmental management decisions and optimal utilization of timber resources (Wang et al 2007a).

All the properties of wood give a great contribution to its functions and applications (Becker 2009). When wood is placed in an electric field, all these properties are governed by certain conditions such as Fiber saturation point, moisture content, temperature, direction of flow of current, density; and components such as cellulose, hemicelluloses and lignin of wood (Kabir 2009).

2. OBJECTIVE: The overall objective was to experimentally verify the applicability of the nondestructive electrical method to monitor the moisture changes in the wood.

3. MATERIAL AND TESTING METHODS: Fig. 1 represents a schematic representation of the sample.Contacts 1, 2 and 3, 4 are on the opposite sides of the sample. The effect of moisture content and other variations were tested on a sample having volume 220 mm^3, with thickness of 20 mm. To measure total resistance, wires were clipped to the sample and a two-probe method was used using Inductance Capacitance and Resistance (LCR) meter. All the tests were conducted at a frequency of 300kHz, at room temperature. While measuring the resistance values for saturated condition, sample was soaked in water for 24hrs, pat dried and then the tests were conducted. Contacts 1, 2 and 3, 4 are on the opposite sides of the sample.

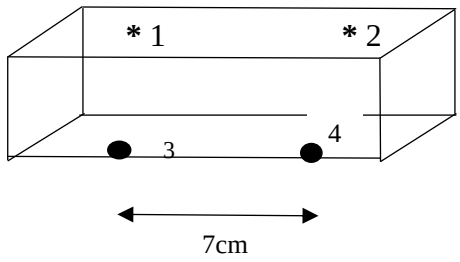

Fig. 1 Schematic representation of the wooden sample

4. RESULTS AND DISCUSSIONS: The resistances were determined in each of the three structural dimensions of the sample (longitudinal, tangential and radial). Results in the Fig-1 and Fig-2 represent the change in resistance of the wooden sample with respect to different directions when soaked in tap water and salty water respectively for a period of twenty-four hours. The salty water was prepared by simulating the salinity of sea water (35gm/L)
Normalized change in resistivity can be represented as $\Delta\rho/\rho_o = \Delta R/R_o$.

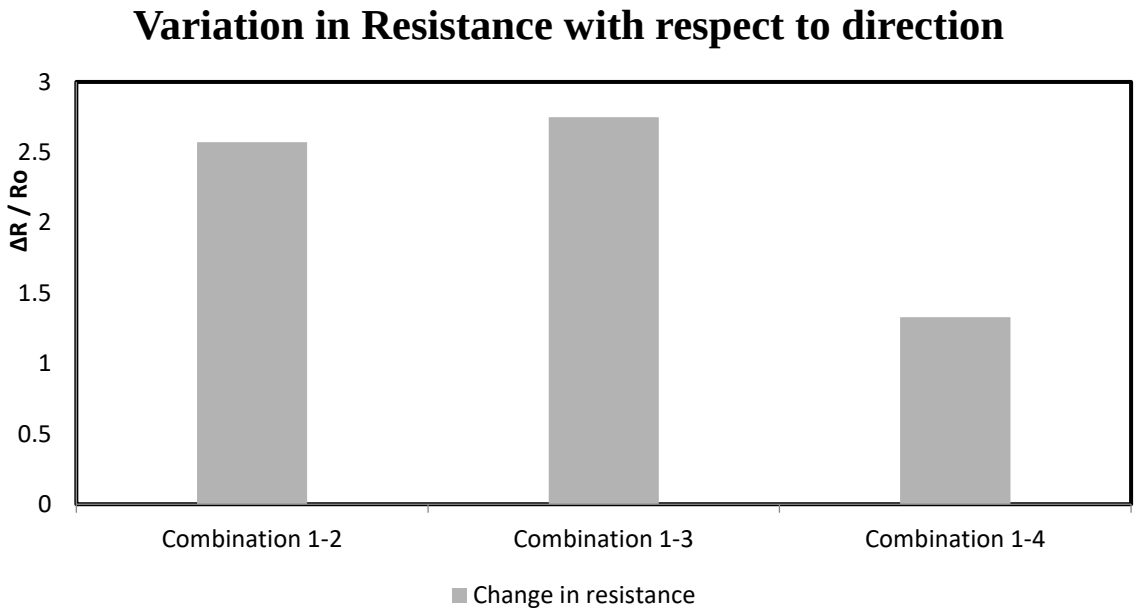

Figure-2. Change in Resistance with respect to different directions when soaked in tap water.

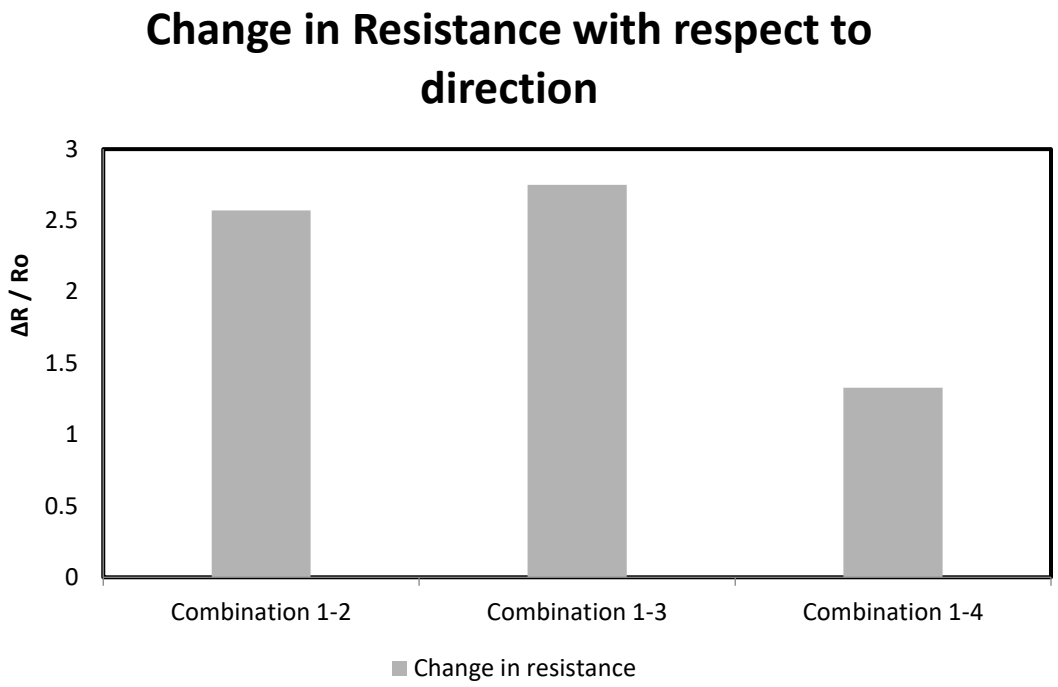

Figure- 3. Change in Resistance with respect to different directions when soaked in salty water.

5. CONCLUSION: Based on the study, we can say that saline conditions decrease the resistance of wood by about ninety to ninety five percent. Hence based on the resistance values obtained we can predict if wood is affected by salty water or regular water.

6. ACKNOWLEDGEMENTS: This study was supported by the Center for Innovative Grouting Materials and Technology (CIGMAT) and Texas Hurricane Center for Innovative Technology (THC-IT), University of Houston, Houston.

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