KILN DRY PROBES VERIFICATION FOR MARITIME PINE AND EUCALYPTUS WOOD

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ABSTRAT

Proper technical drying is a condition for processing sawn timber into high quality products. The drying process is a phase with an extreme importance in wood transformation process, because it gives a significant improvement to the characteristics of workability, prevents damage during transport and insects or fungi attack (Tsoumis, 1991; Walker, 1993). One of the most critical and important phases in the kiln dry is the perfect knowledge of moisture evolution in wood that is drying and is given by the probes measures. Therefore, it became necessary estimate frequently the wood moisture content, which should be at the same time accurate and practical.

The objective of the present study is to verify the fiability of the data given by different probes types, and between the values given by this and the ones obtains by laboratory. This work was done in 2 different industrial dryers and in a laboratory dryer.

There were executed several simple regression analysis to evaluated the existent relation between this ones and the ones obtain in laboratory; it was observed that to values until 30% of moisture it exist a strong correlation between this two parameters but the same it wasn't observed to higher moisture contents.
It was made the confrontation between the result obtain in Maritime pine (*Pinus pinaster*) and Eucalyptus (*Eucaliptus globulus*), and it was observed that the probes can evaluated the moisture content with higher accuracy in pine comparing with eucalyptus.

So, it is necessary have some caution when the probes are disconnected, during the kiln dry process, specially to moisture content values are higher then 30%, because the values given by them are some times liable to error.

Key words: Maritime Pine, Eucalyptus, Kiln dry, Probes, Wood moisture content.

INTRODUCTION

The interest and importance of the wood uses has to consider the regards of fundamentals quality requirements. However, the practical application for these quality requirements needs the adoption of technical procedure that implies the material drying (Lahr, 1999).

Its necessary to have an extreme careful in the final dry phase, when the wood starts to loss water below the Fibre Saturation Point (FSP, when the moisture is between 28 and 30%), because in this phase that the drying defects appears. Therefore, in the final phase the drying time period much be longer and with variations in drying conditions (temperature, moisture and ventilation) less abrupt.

To assume the drying quality and a good quality raw material is essential that the control mechanisms of drying are sufficient and perfectly calibrated. By this way, it shows the importance of verification and calibration in the probes used by the process.

The moisture meters give results less accreted then the kiln method (NP614), but the average water content can be determinate in an immediate form. Normally, the moisture_meters scale oscillate between 7 and 25% of moisture, because above the SFP the resistance variation with the moisture content is not

accentuated as departed by Galvão and Jankowsky (1985). The factors that contributed to the results variation in the moisture meter measurements are: grain direction, moisture gradient, specie, temperature and electrical current variation (current stabilizer).

The way to guaranty the good measurement equipment calibration (wood moisture probes) it is essential to assure the fulfilment of the calibration plane, of which they are part the equipment files, were it can be defined the calibration periods, damage detected, repairing and maintenances, as well as the responsible organism for this operation.

MATERIAL AND METHODS

With the goal of comparing moisture values obtain by indirect method (probes) and the ones by direct methods (laboratorial) the different moistnesses, wood samples of pine and eucalyptus had been used.

This study it was done in two driers of two company units, called A and the Icomatro. For each company were used samples of pine and eucalyptus, respectively 48 samples of pine and 48 of eucalyptus in Icomatro and 39 for pine and 39 for eucalyptus in company A.

In the laboratory, it was determinate the moisture content by laboratorial method, follow NP614 norm from 1973. To this determination, each sample has been immediately weighted and transferred to a kiln, where the initial temperature didn't exceed 60º during the first 4 hours, to avoit an incomplet drying due to the quick surface desiccation. After this slow drying period, the temperature increase to 103 ± 2º. The samples are considered dried when between two consecutives weighing the weigh is constant.

For the graphics elaboration the values had been grouped by an increase order of moisture content in the laboratory.

RESULTS AND DISCUTION

According Galvão and Jankowsky (1985) and Stamm (1964), the moisture evaluation of the electrical resistance moisture meters supplies data with accuracy corresponding around 1%, within 7 and 25 % of moisture, when the moisture meters are in good conservation conditions and carefully used, with the necessary corrections to temperature and species.

Would be convenient that the Industry, not only proceed to probes calibration but also to their constant verification (Nunes et al. 2002).

Maritime Pine

In Figure 1 it is represented the difference between the value of moisture content read by the probes and the one determined by the 4 probes for Icomatro Company dryer and for the 3 probes for Company A, for pine wood.

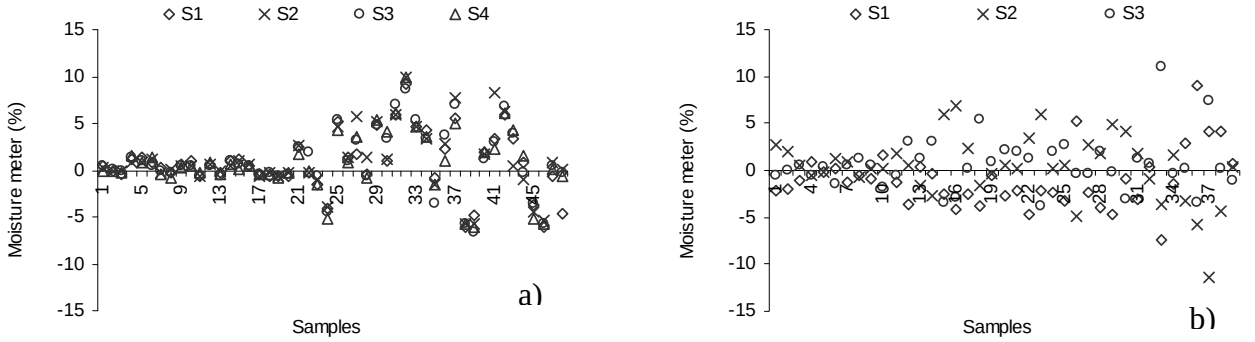

Figure 1 – Moisture content difference (%) determined by the probes and by the laboratory of Pine samples for Iconatro company (a) and company A (b).

By the analysis of Figure 1 a), it is verified that the biggest variation between the moisture values of indicated by the probes and the ones in laboratory occur in the samples with moisture above the SPF, after sample number 24, for Icomatro and after sample number 14 for company A. However, four probes of Icomatro drier give approached values for that they are calibrated, in this case, the differences could only be due the method of measurement. For the company A (Figure 1 b)), the bigger variation is verified between the moisture values indicated by the probes and in laboratory then in the previous company. In this case that, the values determined for the probes are slightly different between itself, what it could be due to a probes.

For both cases it is verified that for moisture values above of the PSF the variation of values given by the proves it is superior to the observed for the moisture values inferior the PSF.

It had been carried through some analysis of simple regression for the existing relation between the values supplied for each one of the probes and the ones gotten by the laboratory. In the graphics of Figures 2 and 3 the existing relations between the values indicated

for each one of the probes of each drier and the ones that were determined by laboratory.

Analyzing the graphics of Figure 2 is evidenced that the values of R^2 for the 4 probes are around 96%, for that, it is possible esteem the moisture percentage in laboratory from the ones gotten for the respective proves, however, the values above of the SFP present weakker adjustments. For the company A, R^2 values are slightly inferior, varying between 85% and 97% what demonstrates the existing a deviation between the three probes. In this case, althought total correlation coefficient values are significant, must have some care with the real moisture values.

The proves are a measurement method indirect for moisture evaluation, having for base the resistance offered by the wood to the passage of the electric corrent. Thus, the values read for the proves are dependents of some factors and a momentary error in one of these factors could be enough to the proves supply wrong temporarily moisture values.

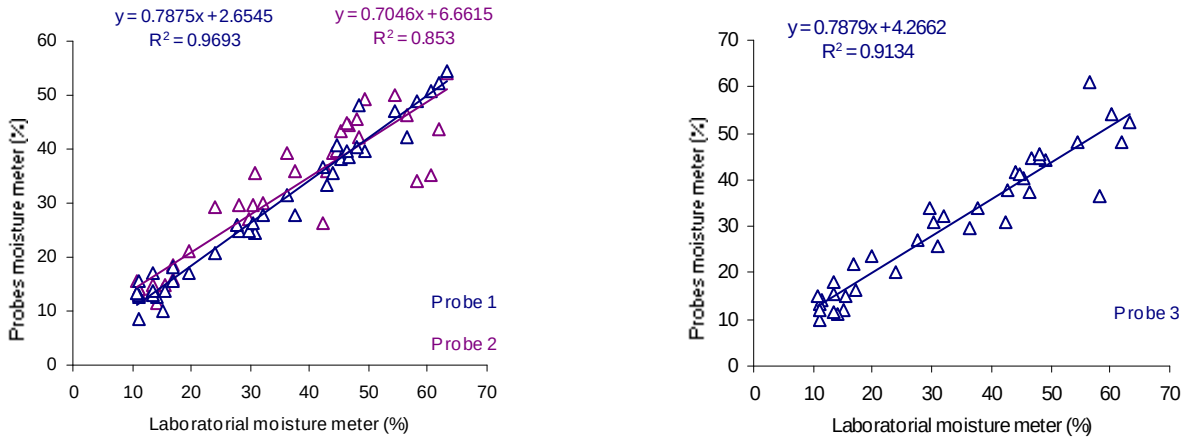

Figure 2 – Relation between the moisture values (%) indicated by the proves and by laboratory, for ICOMATRO company.

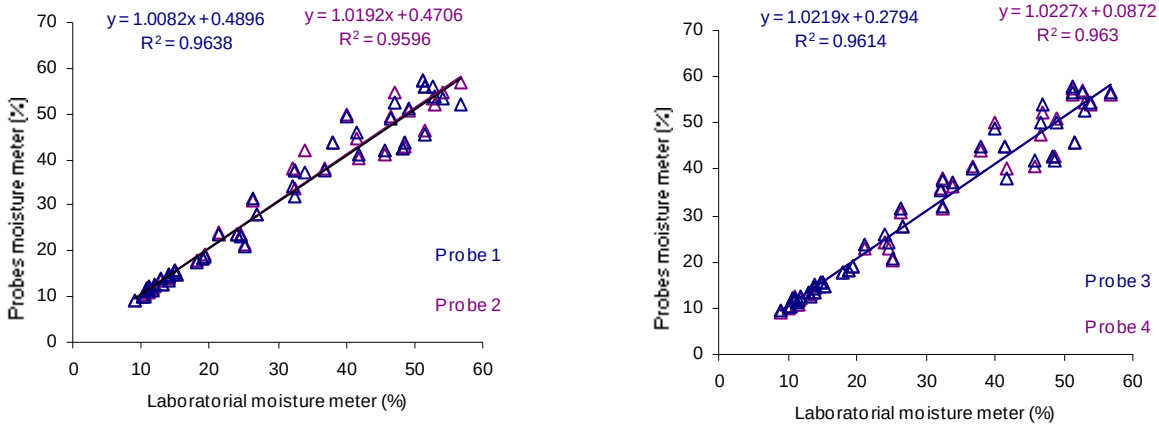

Figure 3 – Relation between the moisture values (%) indicated by the proves and by laboratory, for A company.

The natural wood variability is a factor of great importance in drying process. In fact, when probes are not calibrated it affects in a large scale the effect of the material variability (Anjos *et al.* 2001; Margarido *et al.* 2001).

EUCALYPTUS WOOD

In Figure 4 it is represented the difference between the moisture values obtain by the probes and by the laboratory by the 4 probes in the drier of Icomatro company (a) and for the 3 probes for A Company, for Eucalyptus wood.

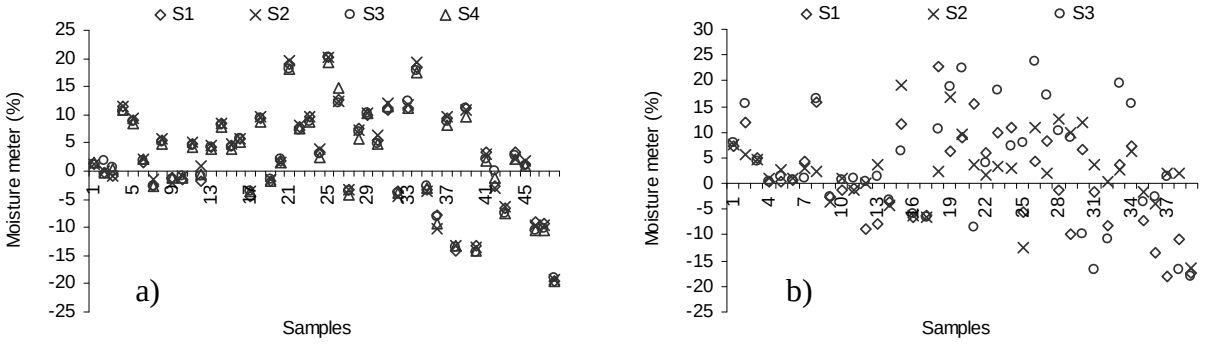

Figure 4 – Moisture content difference (%) determined by the probes and the laboratory from the eucalyptus samples for Iconatro company (a) and A company (b).

For the analysis of the graphics in Figure 4, a deviation is verified between the moisture values indicated by the probes and the gotten by the laboratory, that superior to the ones observed for pine samples. For the eucalyptus samples the deviation occurs equally for the moisture values above and below of the PSF. However, it is continued to verify that for Icomatro company the four probes give similar values, for that the differences observed will be due to the method of measurement and wood characteristics. One more time, for A company (Figure 1 b)), a bigger deviation is verified between the moisture values indicated by the probes and the laboratory for the ones observed by the previous company and a superior values difference determined for each probe.

Such as the values gotten by pine samples, for eucalyptus had been carried through some analysis of simple regression for the existing relation between the values supplied for each one of the probes and laboratory. In the graphics of Figures 5 and 6 it is represented the existing relations between the values indicated for each one of the probes for each drier and the determined by laboratory.

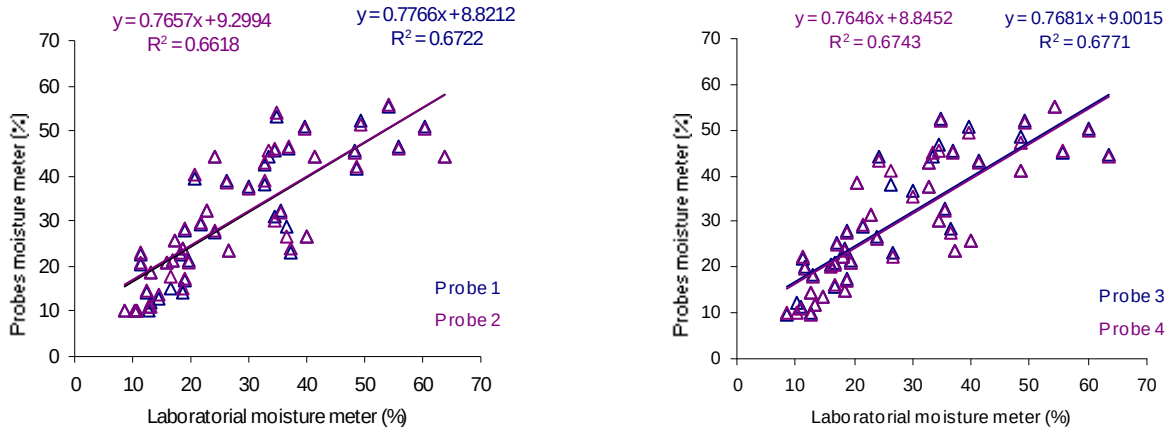

Figure 5 –Relation between the moisture values (%) indicated by the probes and by the laboratory, for Icomatro company.

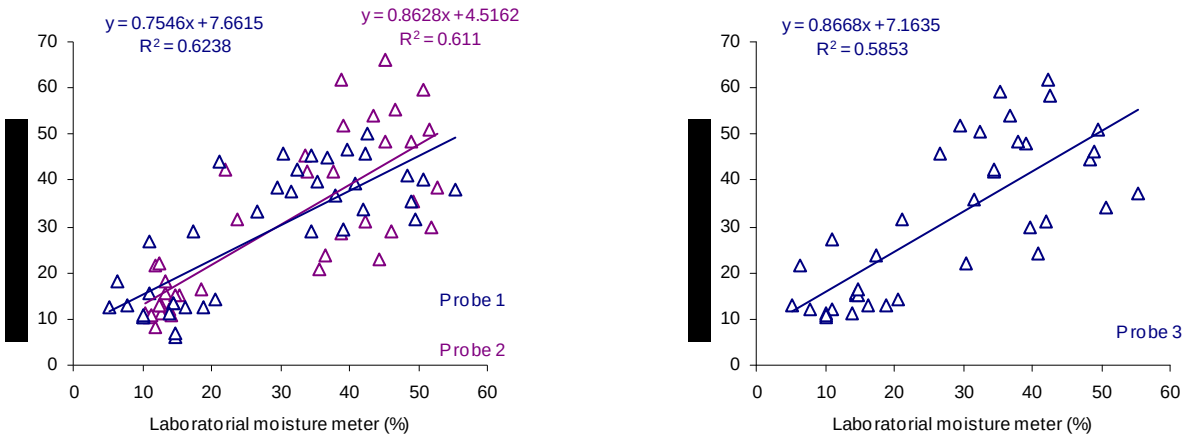

Figure 6 –Relation between the moisture values (%) indicated by the probes and by the laboratory, for A company.

Analyzing the graphics of Figure 5 it is evidenced that the values of R^2 for the 4 probes are inferior to the observed in pine wood, varying between 66% and 68%, for that the estimate moisture percentage in laboratory from the moisture content given by the respective probes is sufficiently lower from the ones gotten previously. Such as for the pine the worse values of correlation is given by the moisture above SFP. For the company A the values of R^2 they are slightly inferior, varying between 58% and 62% what it demonstrates, once more, the existing deviation between the three probes. However, the drying of eucalyptus wood is extremely difficult not only due to the fact of the drying should have a slow processing, but also to the high number of defects that can occur in this wood due to its proper nature. Thus, it can be concluded that for eucalyptus wood it should have some care with the methods of moisture determination, once that the electric methods seem to give not very good values. A deficient calibration of the probes can take to important losses due to the prolongation of drying cycles because of missing readings or to finish the cycles before being reached the final moisture.

CONCLUSIONS

The evolution of the drying conditions depends on moisture evaluated by the probes, being of extreme importance the reliability of the values given for the them.

The probes determine the moisture by indirect methods, being consequently, dependents of some factors, it can not be so precise and be subjective to many errors. In this way, we can be introducing alterations in a drying cycle or silence one probe improperly, with the damages that from there will be able to happen.

Of that it was related, it becomes clear the importance of the probes calibration and verification, its correct use and a periodic revisions.

For eucalyptus wood, the serious problems that some times occurs in the drying can be due to the used electric methods for the wood moisture determination along the drying cycle that will be some timesleading to error and consequently supply wrong datas to the operators. Possibly for this type of wood it would be advisable to use other methods of moisture determination, for a more correct drying conduction.

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