

The impact of open air beech lumber storage on kiln drying. Part II.

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Abstract: *The impact of open air beech lumber storage on kiln drying. Part II.* The analysis of the results indicates that the pre-drying lumber beech open-air humidity of approximately 30% did not cause any significant defects of wood. They must be complied with proper stacking and storage timber

Keywords: lumber beech, moisture content, kiln drying

INTRODUCTION

Wood is a raw material, it has been playing a significant role in the life of human since immemorial ages. The purpose of drying it, is to remove water from it, thus reaching required water content level at which wooden products may be used as intended. There are numerous methods for decreasing water content, however, one most popular and convenient method is kiln drying.

This paper aims at investigating on how the final effect of 28mm thick beech lumber kiln drying can be influenced by its „open air” storage in the preliminary drying phase, and whether it is economically justified.

RESEARCH METHODOLOGY

The research aim is to prove whether it is reasonable to store and dry beech lumber in the open air (especially in the summer season) during initial drying period. In this line of business opinion on the problem under investigation varies and is inconclusive. Knowing softwood properties and parameters, and taking into account the research and observation outcome, an attempt has been made to determine how effective this method is. It has been tested whether the methods generates notable benefits in the form of savings on drying energy purposes. Quality comparison of initially naturally dried lumber and fully mechanically dried lumber has been made.

Electric energy consumption cost and the amount of heat utilized to acquire lumber completion set parameters were calculated from determined coefficients and current existing prices.

RESEARCH RESULTS

This chapter presents diagrams which explain atmospheric condition parameters inside the kiln chamber during drying. In order to read weather and lumber water content data precisely the following devices were used: Tanel XD-30 wood hygrometer, Voltcraft Hygrocube 50 air hygrometer, mercurial thermometer, AM-4836 V FV GW anemometer, and kiln internal devices and sensors. Diagrams below depict data coming from the following three drying methods:

- I – “open air” during preliminary drying stage,
- II – kiln re-drying of formerly “open air” dried lumber,
- III – complete kiln drying.

Open air drying lasted for 5 months and kiln re-drying 222 h. Diagrams for weather conditions during “open air” drying are presented in figures 1,2,3.

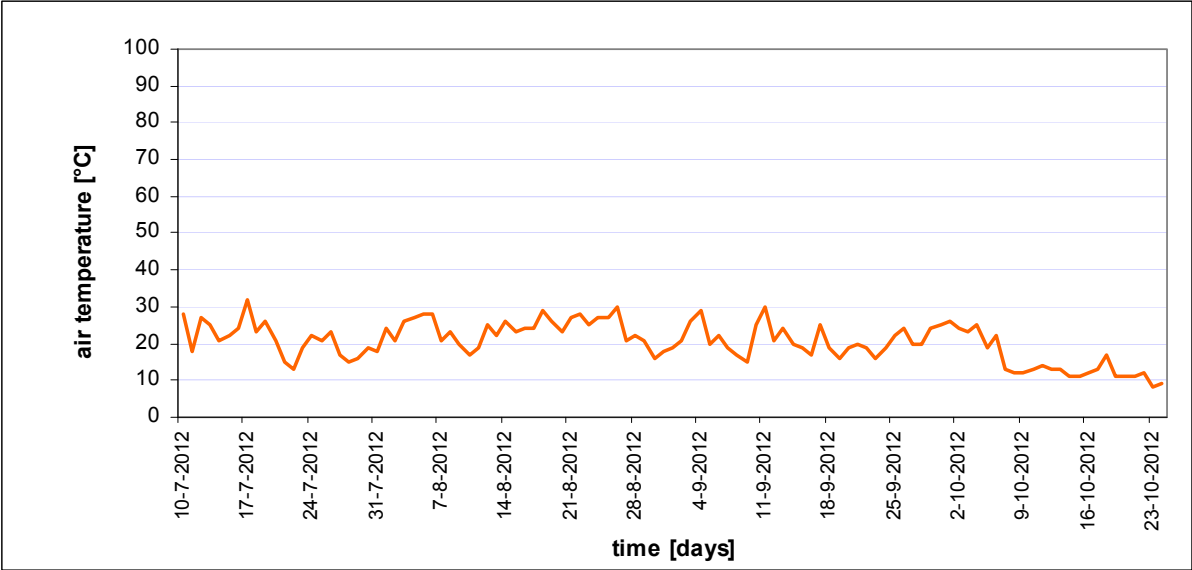


Fig. 1 Air temperature values during preliminary “open air” drying

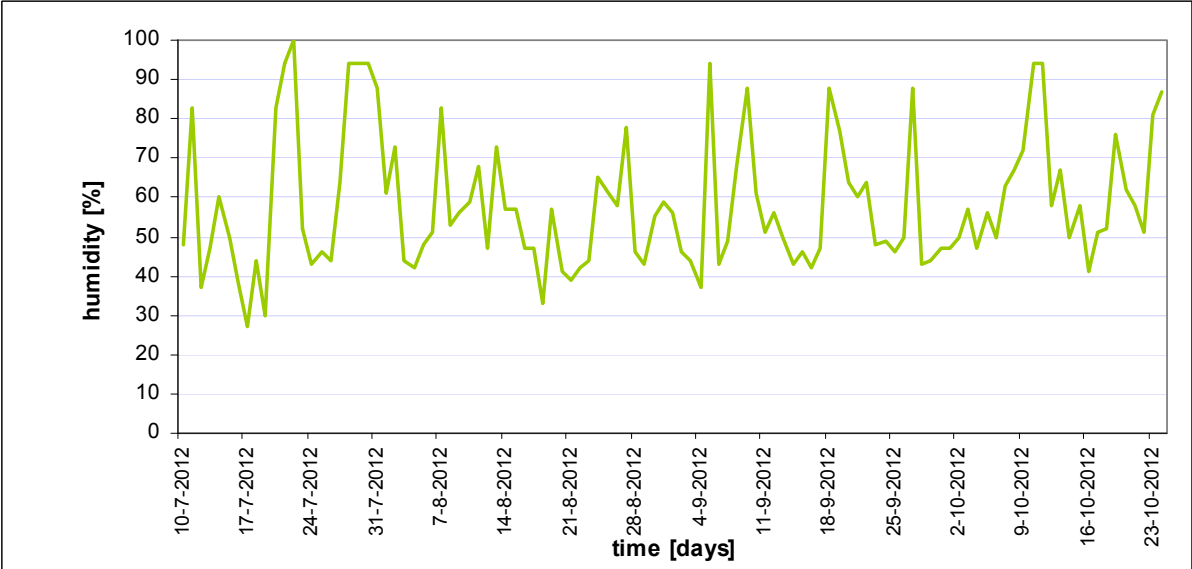


Fig. 2 Air relative humidity values during preliminary “open air” drying

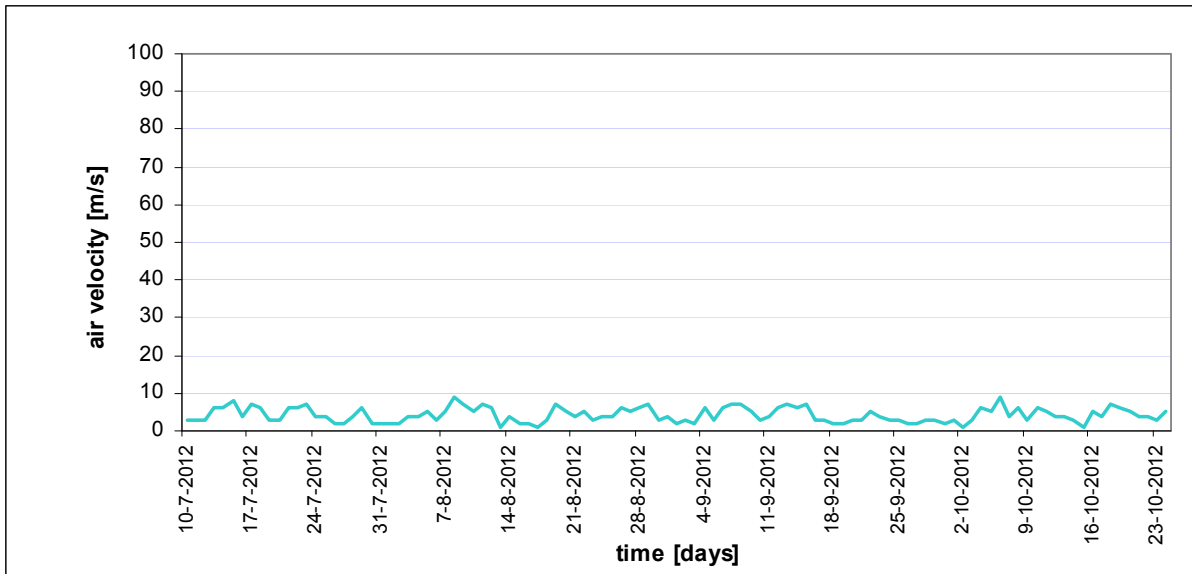


Fig. 3 Air flow speed values during preliminary “open air” drying

Average observed weather parameters values such as: 20°C constant air temperature, air humidity within 65% and wind speed at 2,5 – 3 m/s did not contribute to optimal environment for mold development. Maximum air temperatures (app. 30°C) and strong sunlight had their negative impact on the boards shape. Warping and twisting of individual lumber units and also end checks deeper than 15 mm were observed on 12 % of investigated items. Graphical representation of open air beech lumber drying process is shown in figure 4.

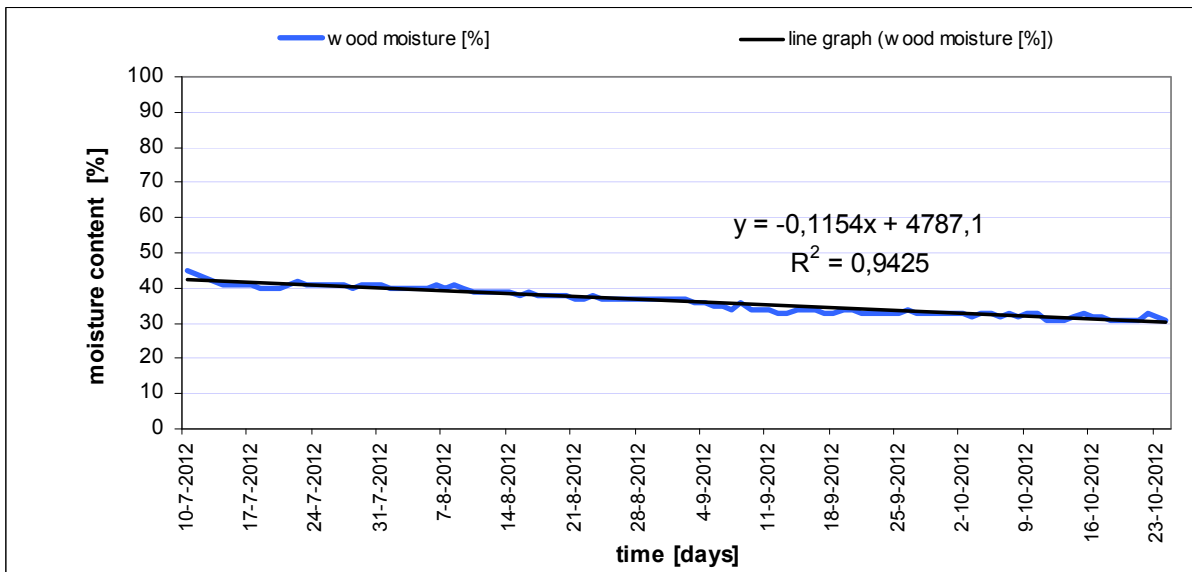


Fig. 4 Water content change during “open air” drying

The drying process course was regular. After approximately 30% average water content in boards was reached, the lumber was placed inside a kiln. The investigated parameters values are shown in figures 5,6,7.

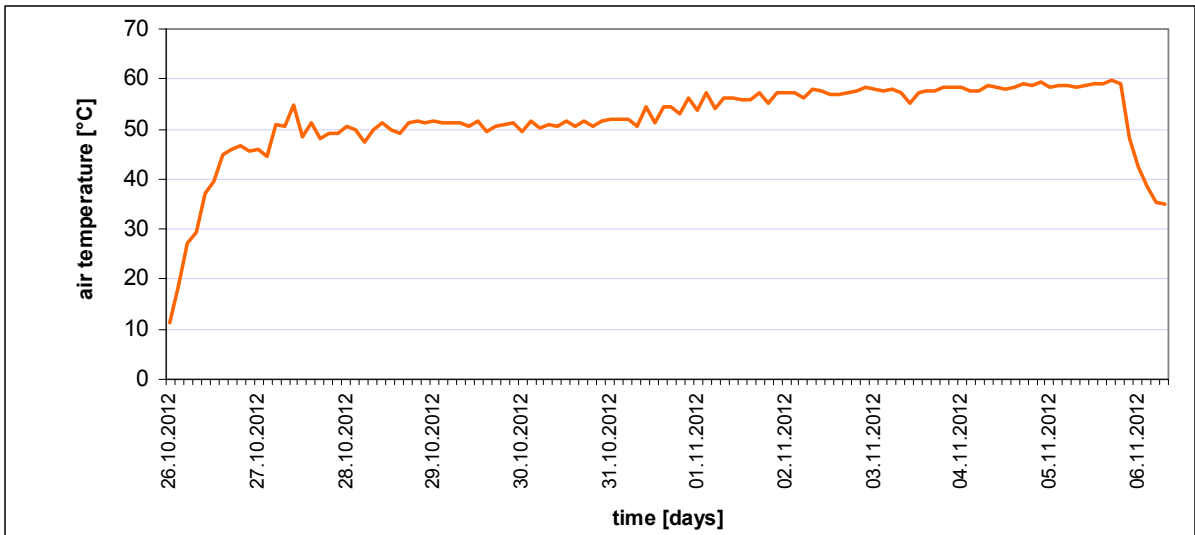


Fig. 5 Air temperature values during re-drying

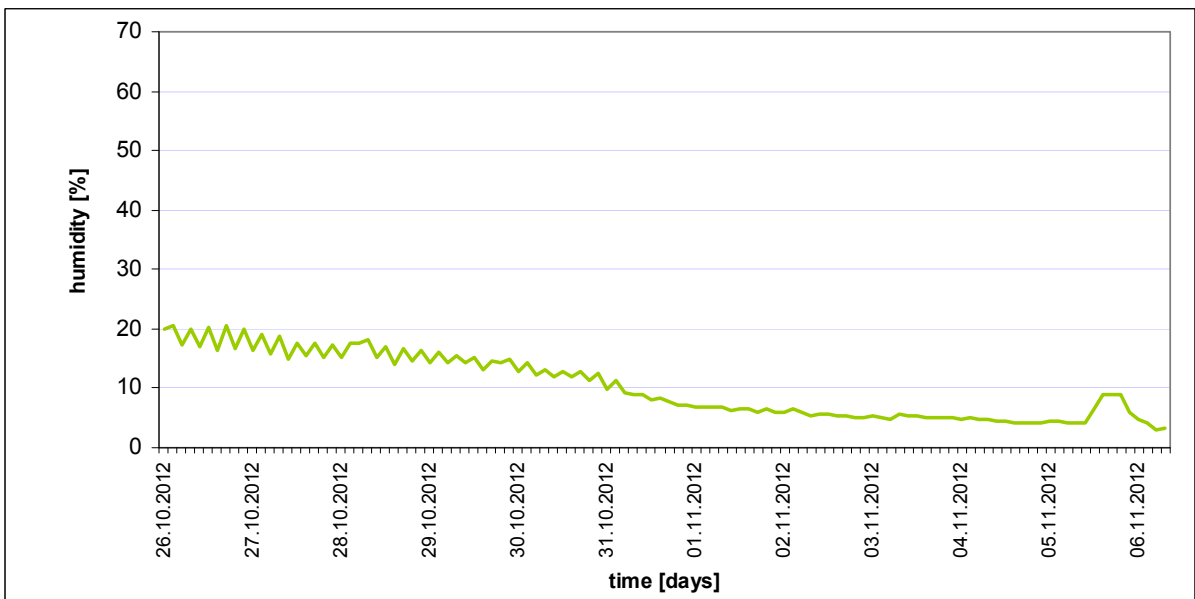


Fig. 6 Air humidity values during re-drying

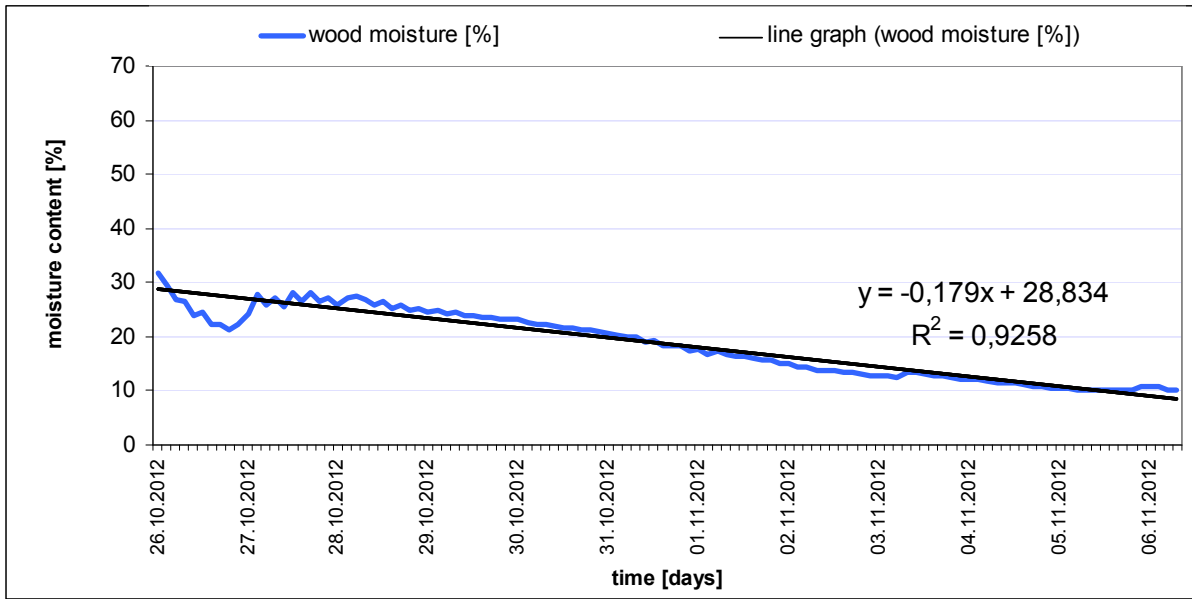


Fig. 7 Wood water content values during re-drying

Batch with initial water content of 32% was heated to 50°C temperature at given air humidity equal to 16%. After 25% wood water content has been reached, air temperature increases to 54°C at humidity decreasing gradually by 1% every 4 hours. In the final drying phase temperature equals 59°C and air humidity drops to 4%, whereas, while lumber conditioning, it increases back to 9% for the period of 5 hours. After the process has been completed, no wood quality deterioration was observed as compared with the moment of loading inside the kiln. Water content distribution was normal, no cracks appeared after the lumber has been unloaded from the kiln nor while its mechanical processing.

Drying process of 28 mm unedged beech lumber directly after it has been sawed is presented in figures 8, 9, 10.

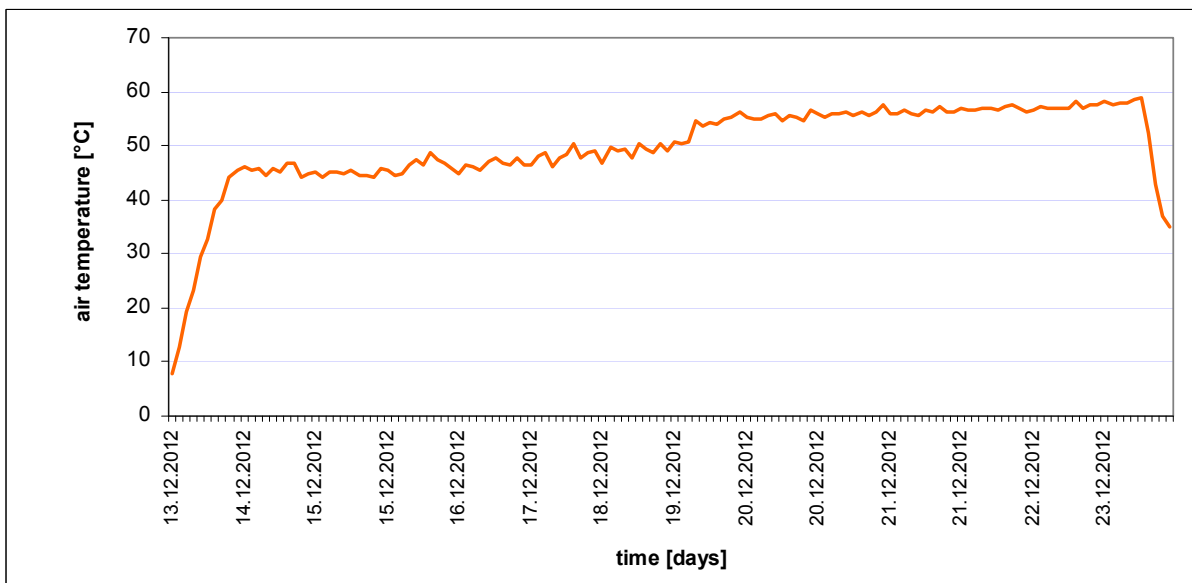


Fig. 8 Air temperature values during drying from the starting point

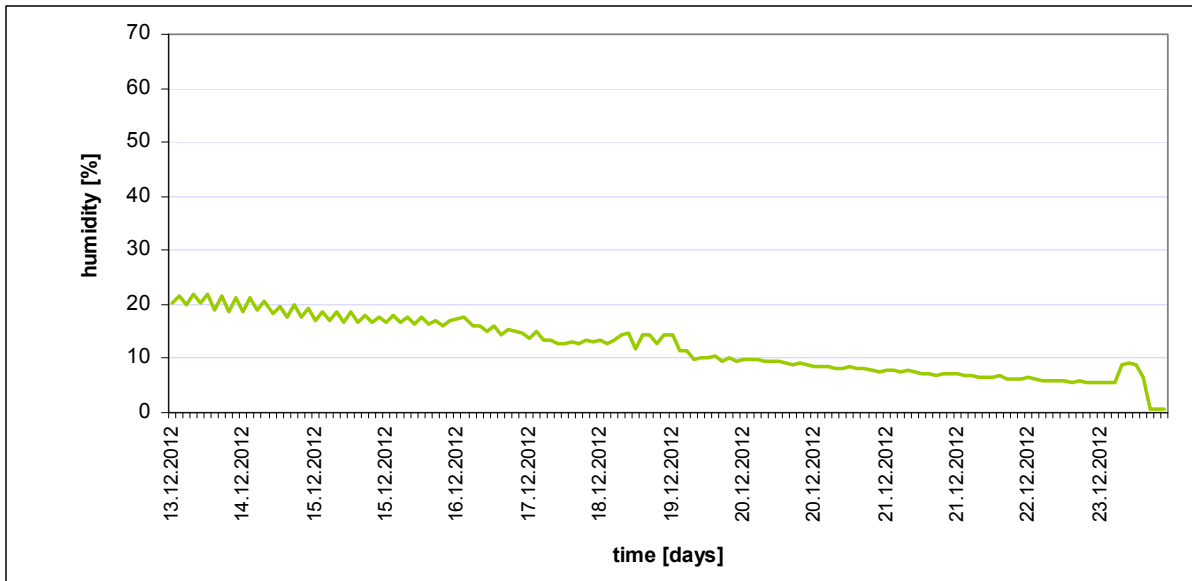


Fig. 9 Air humidity values during drying in a kiln from the starting point

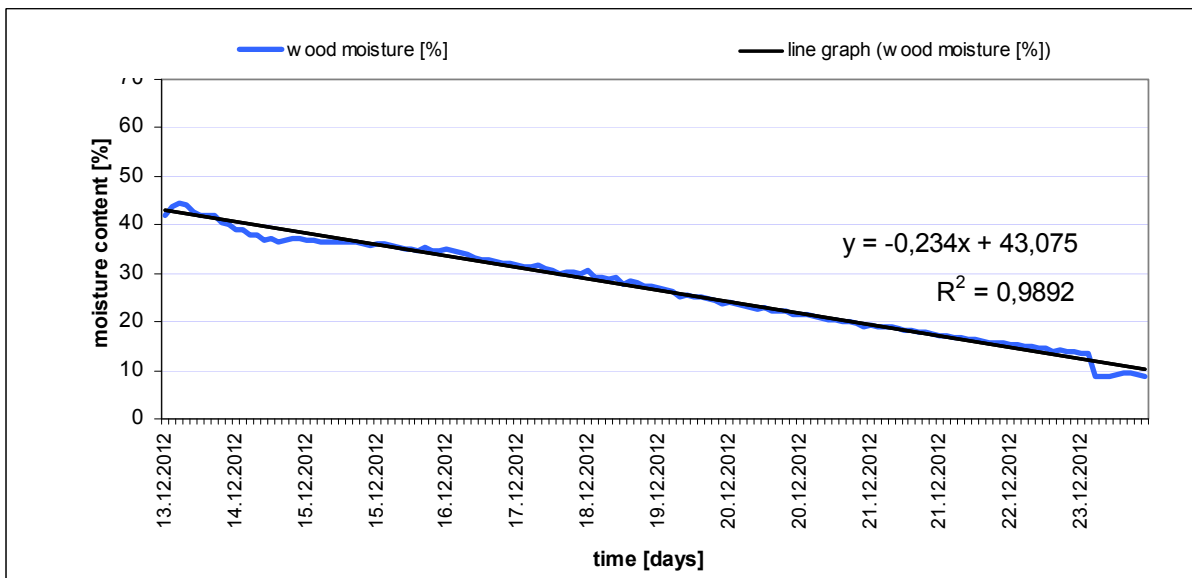


Fig. 10 Wood water content change during drying in a kiln from the starting point

Batch with 42% initial water content was heated for 10 hours to reach the temperature of 50°C at air humidity equal to 16%. After 80 hours, when wood reaches 35% water content, air temperature increases within next 186 hours to reach the level of 59°C at humidity gradually decreasing to the value of 5%, however in the conditioning process it is to increase back to the level of 9%. The cooling process took place in the final drying phase, along approximating of the kiln internal parameters in order to come close to the atmospheric ones. During kiln drying, batch quality was not questionable, wood water content distribution was normal. Numbers of defects in the material were standard. Processing of the material was normal, no cracks were observed after the lumber was unloaded from the kiln. The complete drying process lasted for 279 hours.

SUMMARY

The above analysis indicates, that beech lumber preliminary open air drying in order to reach approximately 30% water content, that is, the moment of removing free water in specified atmospheric conditions, does not cause significant defects in the wood. However, all the requirements for appropriate lumber stacking and storing must be met. Very solid hardwood is much more vulnerable to unfavorable drying conditions, than softwood lumber. The research was carried out in summer from June to October. Consequently, it is necessary to remember, that it is the least advantageous period for lumber open air drying, because of high temperatures and strong sunlight. Apart from appropriate stacking and storing, one has no control over current drying conditions. There is always some risk of occurrence of uncontrollable and unpredictable drying effects. The kiln drying period took place in months: October, November and December, in this period of time discrepancy between kiln temperature and outside temperature was considerable. It was related to increased heat conversion and thermal energy demand.

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Streszczenie: *Wpływ składowania tarcicy bukowej na wolnym powietrzu na suszenie komorowe. Cz. II.* Przeprowadzona analiza wyników wskazuje, że wstępne suszenie tarcicy bukowej na wolnym powietrzu do wilgotności o wartości ok. 30% nie powoduje znaczących wad drewna. Muszą być spełnione warunki prawidłowego sztaplowania i składowania tarcicy.

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