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Possible test procedure for analysing the influence of MC on wood surface geometry

Rami Benkreif[1*], Csilla Csiha[1]

[1]University of Sopron, Faculty of Wood Engineering and Creative Industries, Institute of Wood Engineering. H-9400 Sopron, Bajcsy-Zs.E.u.4. Hungary

E-mail: rami.benkreif@phd.uni-sopron.hu; Csilla.Csiha@uni-sopron.hu

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ABSTRACT

Wood surface roughness is a major quality factor especially in furniture production were adhesive and coating need to be applied. Many factors influence the wood surface roughness such as wood anatomical structure, density, machining etc. Varying moisture content of wood causes shrinking and swelling of the surface. The question, how wood surface changes its roughness due to MC changes. It can be supposed that even the way how the once dried surfaces raise their moisture content may be of relevance from the point of view of the roughness results. One way to increase moisture content of artificially dried wood samples is to climatise them in a chamber at fixed temperature and increasing air humidity, whilst measuring the MC of wood samples in a moistening process. The other way is to soak the samples in water and to subject them to a drying procedure, whilst measuring the MC of wood samples in a drying process (Benkreif et al 2021). The aim of this research is to find the difference between the effect of an increasing and of a decreasing MC process on the surface roughness of wood. The soaking method indicated smaller changes in the roughness values than the changes occurring during the chamber treatment. The surface roughness change due to MC increase and decrease show trend that described by a polynomial equations.

INTRODUCTION

Wood is a natural material continuously changing its moisture content according to the environment's humidity. It have wide range application especially in furniture production. Surface quality of solid wood considred one of the most important characteristics that influence further manufacturing processes such as finishing or their adhesive strength characteristics (Magoss 2008). Surface roughness of wood can be influenced by many factors including annual ring variation, wood density, cell structure earlywood and latewood ratio. Surface irregularities on solid wood usually are not recognized as much as other engineered surfaced such as metals and plastics. Surface roughness of wood determined as numerical values utilising various terms employing different techniques. When wood member is exposed to high humidity environment its surface will not only become rougher but also will influence amount of finishing material used, bonding strength or/ and overall quality of joint (Zhong et al. 2013).

Pinewood is a kind of softwood that grows in many varieties in various parts of the world. It has a uniform texture, easy to work and finishes well. It also has some resistance against shrinkage, swelling and warping. Pine is usually has light yellowish colour and it has a broad grain pattern. Cherry is a hardwood that has a red brown colour. It has as well closed grain and resists warping and shrinking, which make it an excellent raw material for furniture production (Zhong et al. 2013).

Since roughness plays major role in manufacture, furniture the question that rise is how an artificially dried wood surface changes its roughness due to MC changes is rather under evaluated in the literature (E. Magoss, 2008). In order to study the wood surface roughness change due MC change it better to study different method that influence the MC like increasing MC with climate chamber or the opposite soaking wood on water than decrease it. The aim of this research work is to find mathematical function that could describe the surface roughness change due MC on radial and tangential cut of soft and hard wood, and the difference between the two methods of MC change.

EXPERIMENTAL METHODS

For this study two types of wood were used, one hard wood: cherry (*Prunus*) and one soft wood: scots pine (*Pinus sylvestris*) both with radial and tangential cut. Surface was sanded with sanding belt of 120 grit size and samples were cut to dimension of 70 mm x 50 mm x 15 mm. After samples preparation, first group of specimens were put in climate chamber for temperature of 20 °C and relative humidity of 90 % until reached 6 %, 8%, 10 %, 12 %, 14 %, 16 %, 18 % and 30 % MC. Parallel, second group of specimens were soaked into water for one week, than dried to moisture content of 30 %, 18 %, 16 %, 14 %, 12 %, 10 %, 8 %, 6 %. On every sample 10 surface roughness measurements were performed, for each combination, using MAHR S2 Perthometer according to standard EN ISO 4288, and the following parameter were recorded: Rq, Rz.

RESULTS AND DISCUSSION

After tests, results were studied and represented in the figures below (Fig. 1-4), relation between MC and surface roughness with parameters RZ and Rq was plotted. The illustrated figures (1-4) show that roughness and MC are represented as polynomial function with 2nd and 3rd degree. Small difference in surface roughness between the two wood species. When compare the results of radial and tangential cut no significant difference occurred accept for scots pine on radial cut with soaked water method. Results indicated that roughness is much higher with soaking the wood into water that increasing the MC with chamber climate. Most of the surface roughness vs MC results demonstrated that possible mathematical representation could be made to describe the surface roughness change due MC change.

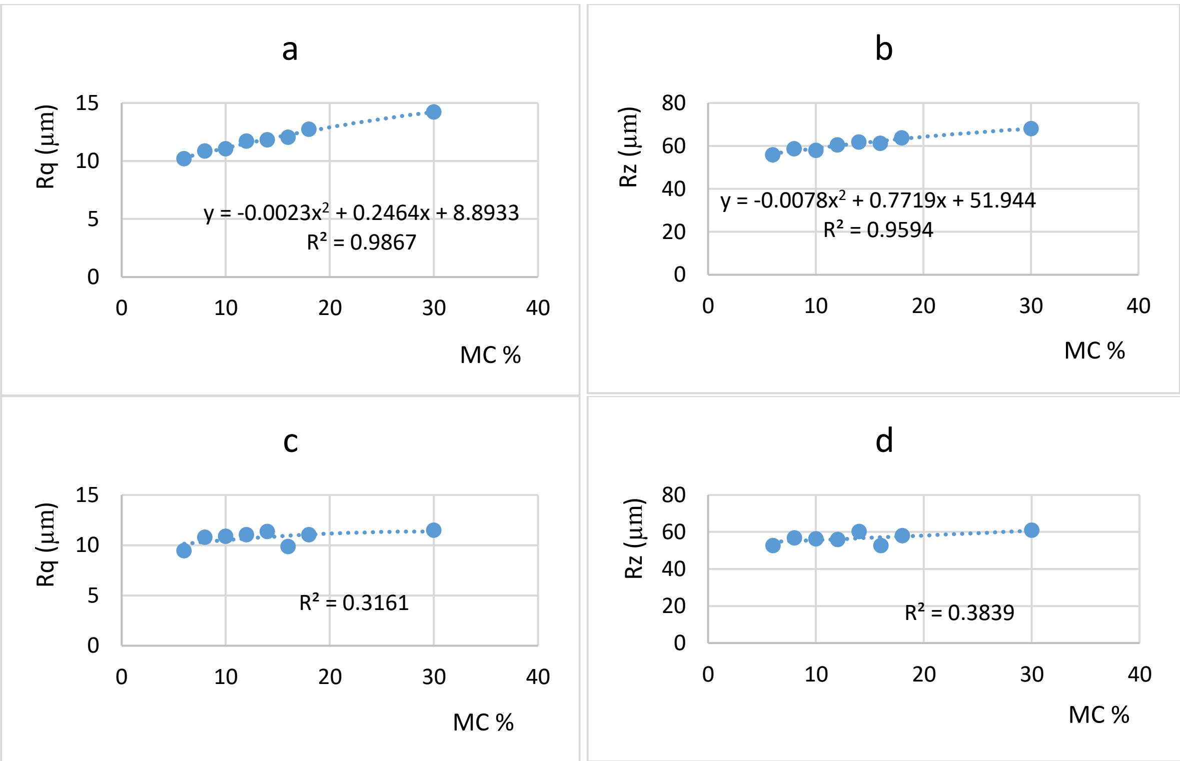

Figure 1: Scots pine samples a) Rq for tangential cut soaked in water. b) Rz for tangential cut soaked in water. c) Rq for radial cut soaked in water. d) Rz for radial cut soaked in water

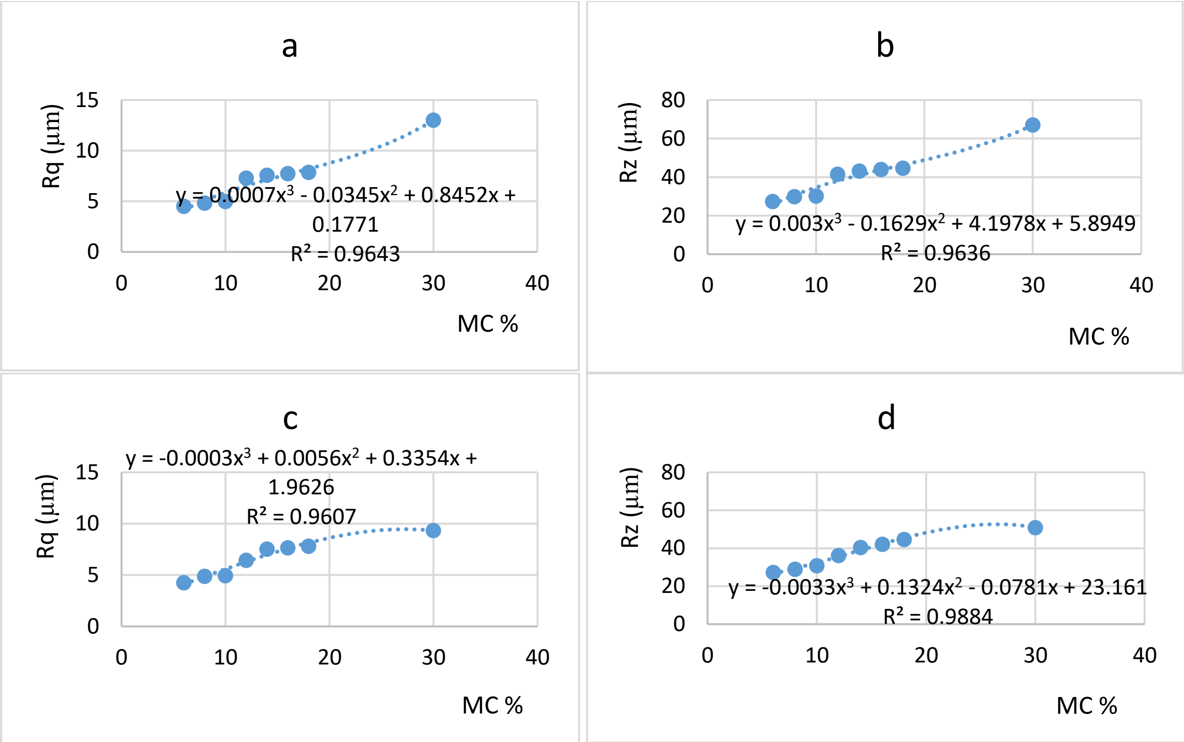

***Figure 2:** Scots pine samples a) Rq for tangential cut climate chamber. b) Rz for tangential cut climate chamber. c) Rq for radial cut climate chamber. d) Rz for radial cut climate chamber.*

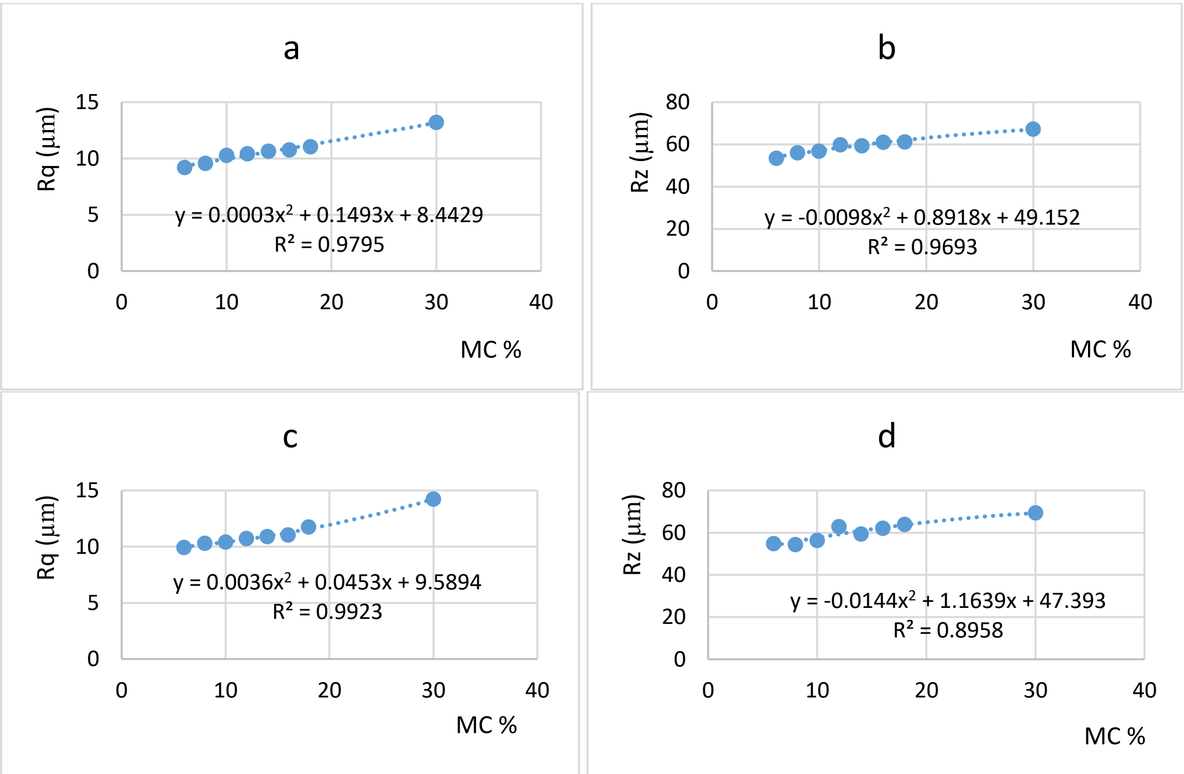

***Figure 3:** Cherry samples a) Rq for tangential cut soaked in water. b) Rz for tangential cut soaked in water. c) Rq for radial cut soaked in water. d) Rz for radial cut soaked in water*

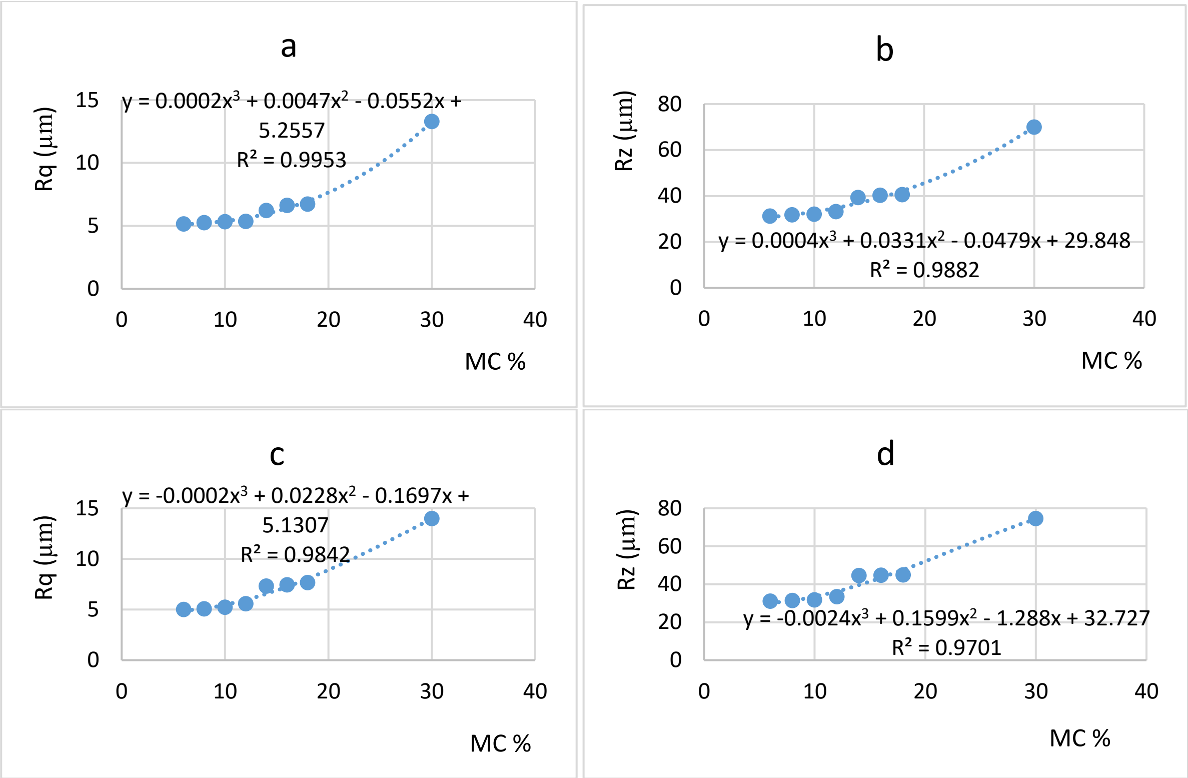

Figure 4: Cherry samples a) Rq for tangential cut climate chamber. b) Rz for tangential cut climate chamber. c) Rq for radial cut climate chamber. d) Rz for radial cut climate chamber.

CONCLUSIONS

As a conclusion, it was found that soaking method had smaller changes in the roughness values than the changes occurring during the chamber treatment. After measurements with both methods (soaking in water and chamber climate), results were studied figures showed a trend for results that was translated to a polynomial function from 2^{nd} and 3^{rd} degree for both Rq and Rz on scots pine and cherry. However, an expected result was found for Rz values for scots pine on soaked water method, results indicated that no trend or function could describe the Rz of scots pine with soaking into water method on radial cut. In the end, the results showed that not all wood species moister content could be fitted into function and the used method itself and the wood cut can influence the result.

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