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Short Communication

Evaluation of extractive content in Albanian white oak (*Quercus petraea* Liebl)

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Wood extractives are organic components that even not being part of the cell wall, have an important impact on wood properties and its utilization. The study was carried on extractives content of white oak (*Quercus petraea* Liebl). Eighteen sawdust samples were taken from cuts in six different heights of three trees. The extraction is done with Soxhlet 250 ml capacity, for about 6 h. The content of extractives decreased from the base to the top of the tree and their content in wood was 4.7%. This result is near to those recommended in literature for *Quercus* sp.

Key words: Extractives, extraction solvent, Soxhlet, evaporator, white oak.

INTRODUCTION

Extractives are compounds presented in trees. They can be extracted by organic solvents. They are found in higher concentrations in the bark of most woods and generally are considered to be biosynthesized in order to slow or prevent pathogen invasion. Their production is under strict genetic control, and some individual compounds are limited to individual species.

The content of extractives and their composition vary greatly among different wood species and also within the different parts of the same tree (DeBell et al., 1999; Gartner et al., 1999; Gierlinger and Wimmer, 2004). Extractives are not considered to be structural components of wood. In general, the overall percentage of the extractives in wood varies from 2 to 10% with the exception of some tropical wood species (from 20 to 25%). Extractives are usually divided into three sub groups: (1) Aliphatic compounds; (2) terpenes and terpenoids, and (3) phenolic compounds. They can also be divided into two main classes: (1) Extractives deposited in the coarse capillary structure, and (2) extractives deposited in the cell wall structure (Stamm and Loughborough, 1942).

Some undesirable effects of extractives are: Increased chemical consumption for pulping and bleaching (Erkman et al., 1990); tannins can corrode metals; they can interfere with setting of paints, glues and varnishes; they can migrate during drying causing discoloration. On the other hand, some of them, but not all, are toxic to decay organisms or insects. Heartwood containing more extractives is more durable and last longer than sapwood. Also, extractives give dark color to wood and provide a better dimensional stability (Boiciuc and Petrician, 1970).

The objective of the study regards extractives content of white oak (*Quercus petraea* Liebl), which is the most important of broadleaves in Albania after the beech (*Fagus sylvatica* L). It forms mixed forests with beech and Austrian pine (*Pinus nigra* L). Actually there is an interest of local wood processing industry regarding to white oak as raw material for barrels, furniture, floors and parquet, also for some parts of wooden dwellings.

MATERIALS AND METHODS

Three trees of white oak were randomly sampled in October from Biza plantation in Martanesh region in Albania.

The plantation was a mixed natural forest more than 150 years old, where white oak constituted one third of its total standing volume. It was situated 75 km to east of capital city, Tirana, with an altitude ranging from 450 to 1160 m and it presented almost the same features of other forest regions where white oak can be found.

From each tree (without bark), six discs were cut at 20 cm from the base of the tree, every 25 cm intervals. The sawdust generated during the cross-cutting was collected to form six samples for the experiment.

The sawdust samples were dried in oven at 105 ± 3°C for 2 h

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Table 1. Results of extractions[1].

Tree	Number of tests[2]	WBE (g)	Mean WBE (g)	WE (g)	Mean WE (g)	E (%)	Mean E (%)
1	1	4.72	4.74 (0.132)	0.228	0.221 (0.012)	4.83	4.66 (0.14)
	2	5		0.24		4.8	
	3	4.68		0.22		4.7	
	4	4.65		0.214		4.6	
	5	4.66		0.211		4.53	
	6	4.72		0.211		4.5	
2	1	5.02	4.87 (0.091)	0.244	0.23 (0.009)	4.85	4.73 (0.11)
	2	4.92		0.238		4.84	
	3	4.83		0.23		4.76	
	4	4.86		0.227		4.67	
	5	4.77		0.221		4.64	
	6	4.8		0.221		4.61	
3	1	4.79	4.92 (0.138)	0.234	0.231 (0.004)	4.88	4.7 (0.13)
	2	4.71		0.225		4.8	
	3	4.99		0.237		4.74	
	4	4.99		0.231		4.62	
	5	5.01		0.231		4.6	
	6	5.05		0.23		4.55	

[1] The applied method does not take into account the extractives which evaporate under 105°C.
[2] The numbers of tests are lined from the base to the top of the tree; standard deviations are in parentheses.

((Willför et al., 2006), milled and screened through 40 to 60 mesh. The material particles to be used for extraction were about 0.4 mm. Analysis of extractives were carried out in accordance with TAPPI method (T204 om-88). Each sample was extracted with ethanol 95% (Nelson and Birkett, 2004).

The extraction apparatus consisted of Soxhlet extractions units, connected to 250 ml flat-bottomed flasks and condensers. Approximately 5 g per sample was weighed into tarred cellulose thimbles and extracted with 200 ml of solvent for 6 h. After extraction, the solvents were evaporated. The remaining extracts were weighed and expressed as percentage of oven dried mass of the sample in the thimble.

RESULTS

The mean weight of dried material before extraction (WBE) was approximately 4.84 g and the mean weight of extractive (WE) after the evaporation process was approximately 0.227 g. The percentage of extractives (E) in white oak (*Q. petraea* Liebl), resulted as shown in Table 1 and Figure 1.

$$E = (WE/WBE) \times 100\ (\%)$$

According to the calculations, it was concluded that the content of extractives in wood which was approximately 4.7% was used as the mean of all performed measurements.

Linear relationship presented in the graphic showed that percentage of extractive content is reduced linearly with the height of the stem. The estimated standard error resulted 0.34% and the coefficient of variation of extractives content was 3.66, implying that variation of extractive content was low between sample trees.

Literature gives values for different species of *Quercus* from 4.4 to 13.2% (Hillis and Sumimoto, 1989), but none of them regarded *Q. petraea* Liebl. This result is near to literature data for *Quercus* sp.

The white oak is considered as one of the most widespread and utilized hardwood in Albania. Knowing the exact amount of extractives in it would be very helpful on how to process and where to use it.

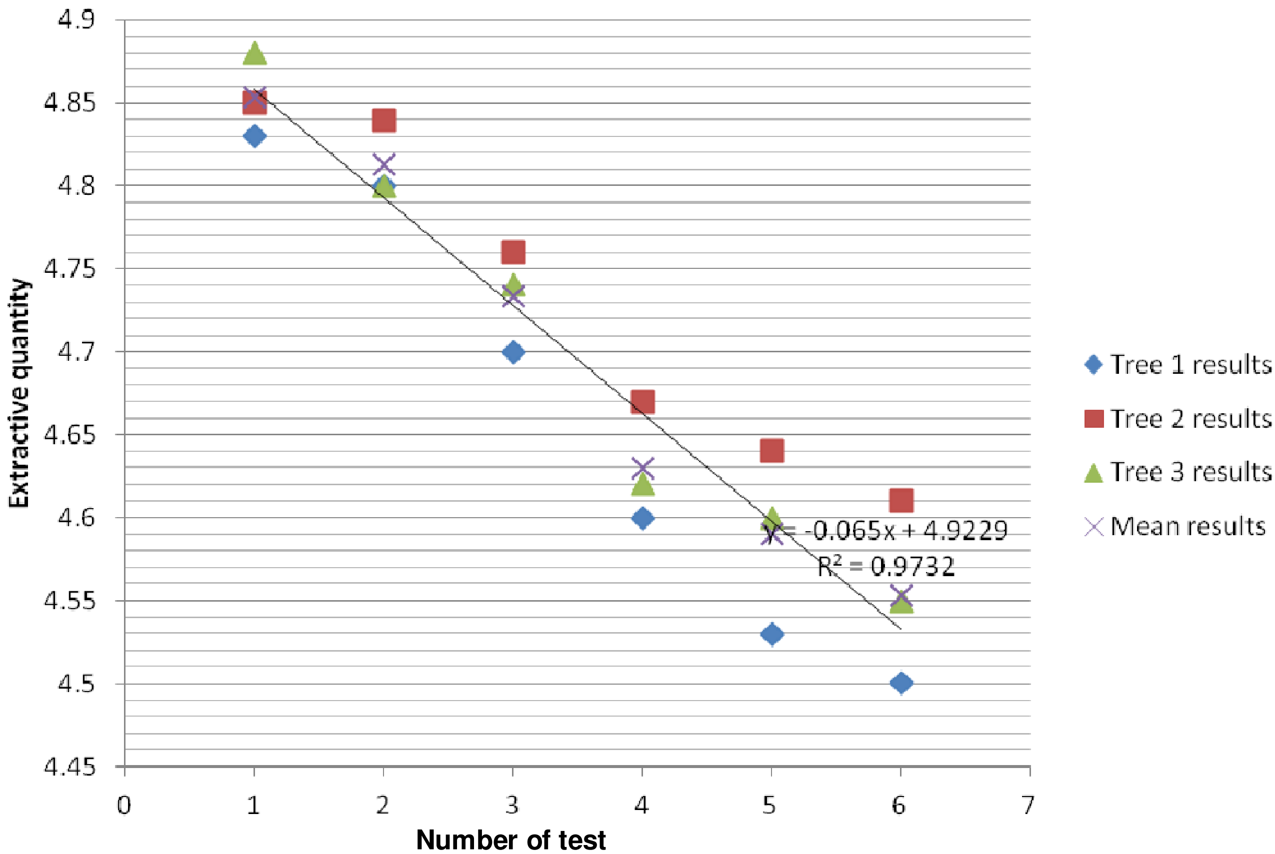

Figure 1. The relation between extractive content and height of tree. The numbers of tests are lined from the base to the top of the tree.

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